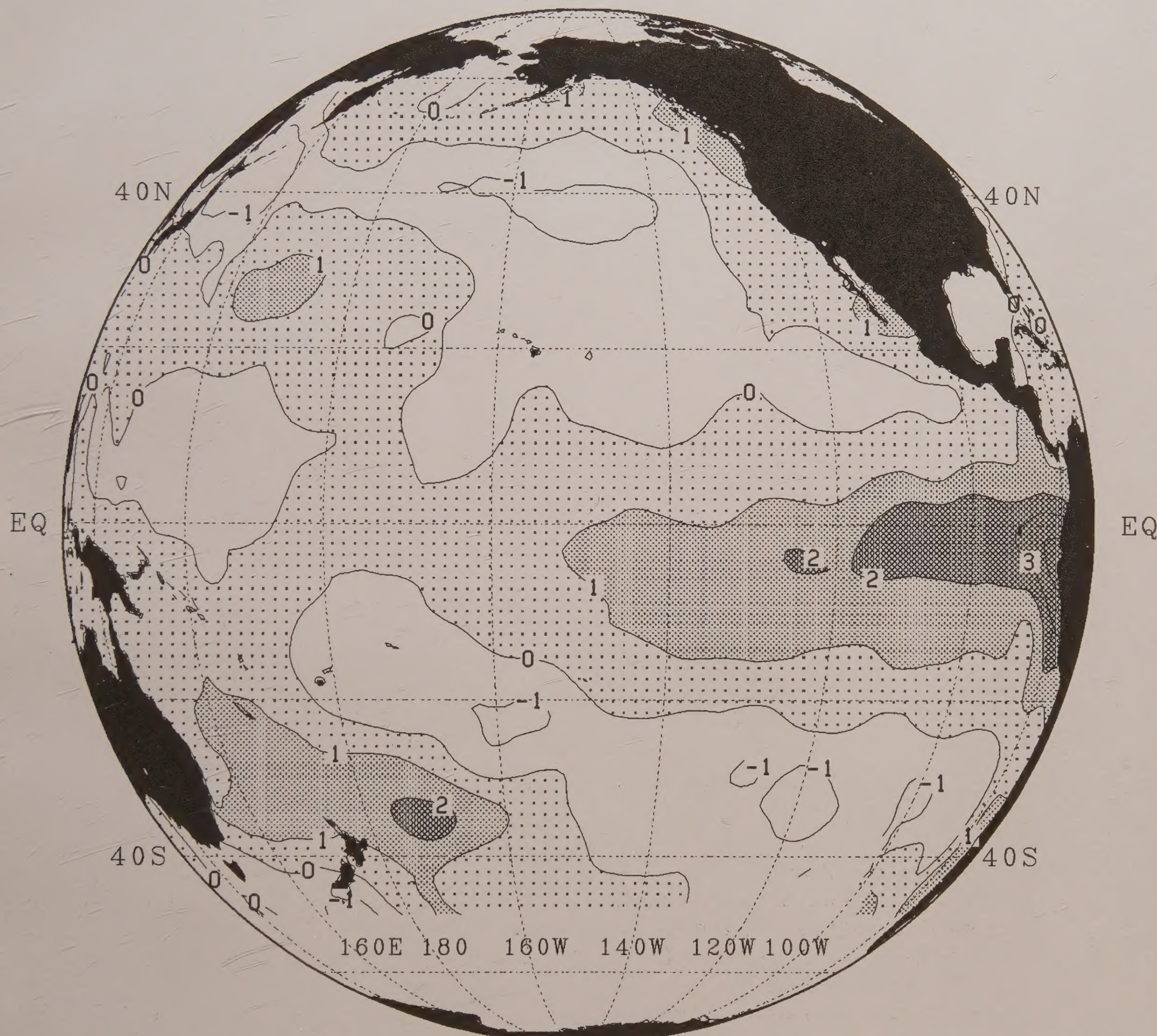
気象庁海洋月報

Monthly Ocean Report

April 1998 (No. 64)



Climate and Marine Department
Japan Meteorological Agency

気象庁 気候・海洋気象部

平成１０年４月

気象庁海洋月報は、気象庁 気候·海洋気象部 海洋課で作成しています。
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Monthly Ocean Report is prepared by the Oceanographical Division, Climate and Marine Department, Japan Meteorological Agency.

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表紙は、1998年4月の太平洋の月平均海面水温偏差図です。
陰影部は、平年より高温の海域を示しています。

The figure on the front cover shows the monthly mean SST anomalies for April 1998 in the Pacific Ocean.
Areas of positive anomalies are shaded.

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海況の特徴（１９９８年４月）

日本近海の海況

海面水温は，日本海北部及び北海道の東から三陸沖にかけて平年より１℃以上低く，本州の南で平年より0.5℃以上高かった（第4図）。

黒潮は，中旬までは九州から紀伊半島にかけて接岸していたが，下旬には九州の東で離岸する流路となった。四国及び紀伊半島には月を通して接岸した後，東進し，三宅島と八丈島の間を経て，房総半島沖を北東に流れていた（第9図）。

親潮系の冷水の沿岸寄りの分枝は37.8°N，142.5°Eまで達していた（第5図）。

太平洋の海況

太平洋赤道域の海面水温は，150°W以東で平年より１℃以上高く，南米沿岸には＋3℃以上の正偏差が見られた。エルニーニョ監視海域（4°N～4°S，150°W～90°W）の海面水温偏差は，1997年11月以降減少し続け＋1.8℃となったが，海面水温は28.9℃と高い状態が続いていた（表1）。

北太平洋では，40°N付近の160°E以西及び170°W～140°Wに−1℃以下の負偏差が見られた。30°N，170°E付近は＋1℃以上の正偏差となった。北米沿岸の正偏差は３月より弱まった（第16図）。

Highlights April 1998

Seas adjacent to Japan

SST anomalies exceeding -1°C were found north of the Japan Sea and from east of Hokkaido to off Sanriku. SSTs were more than 0.5°C above normal south of Honshu (Fig. 4).

The Kuroshio flowed along the coast of Kyushu in the first and second 10-days, and it flowed off Kyushu in the last 10-day. After passing along the coasts of Shikoku and Kii Peninsula, it flowed eastward and passed between Miyake Island and Hachijo Island, then flowed northeastward off Boso Peninsula through the month (Fig. 9).

Coastal branch of the Oyashio cold water extended southward to 37.8°N, 142.5°E (Fig. 5).

Pacific Ocean

In the equatorial Pacific, SSTs were more than 1°C above normal east of 150°W. SST anomalies exceeding +3°C were observed near the South American coast. The SST anomaly of El Niño monitoring region (4°N-4°S, 150°W-90°W) has steadily decreased since November 1997, and was +1.8°C in April, while the actual mean SST of 28.9°C has still kept high value (Table 1).

In the North Pacific, SST anomalies exceeding -1°C along 40°N were observed west of 160°E and between 170°W and 140°W. Positive SST anomalies exceeding +1°C were found near 30°N, 170°E. Positive SST anomalies along the North American coast were weakened (Fig. 16).

日本海固有水の長期変動について－その１．水温

Long-term Variation of the Japan Sea Proper Water － Part 1. Temperature

舞鶴海洋気象台の観測船「清風丸」は，年４～５回定期的に日本海の観測を行っている。1958 年から 1996 年までの観測データを使って，観測点 P（図 A）における日本海固有水のポテンシャル水温の長期変動を調べた。

日本海の水は，対馬暖流の流れる表層水と，その下に存在する日本海固有水（500 m 以深に存在する水温 1 ℃以下の深層水）とに分けることができる。水温の季節的な変動が大きな表層水に対し，日本海固有水の水温は季節変動よりも経年変動が卓越している。

測点 P における基準層（800，1000，1200 m 深）のポテンシャル水温を，1958 年からの時系列（図 B）で示す。いずれの層でもポテンシャル水温は統計的に有意な長期昇温トレンドがあり，100 年当たりの上昇率は 800 m層で 0.16℃，1000 m層で 0.15℃、1200 m層で 0.12℃に達する。

The R/V Seifu Maru of the Maizuru Marine Observatory/JMA has been observing oceanographical conditions periodically in the Japan Sea several times a year. Long-term variation of the potential temperature within the Japan Sea Proper Water (JSPW) are analyzed by using the data from 1958 to 1996 at the Station P (Fig. A).

The water of the Japan Sea can be vertically divided into two types. One is the subsurface warm water including the Tsushima Warm Current, and the other is the JSPW under the subsurface warm water. The temperature of the JSPW is colder than 1℃ and it exists deeper than 500 m. Though the temperature of the subsurface warm water shows large seasonal variation, long-term variation dominates in JSPW rather than seasonal variation.

The time series of the potential temperatures at the standard depths are shown in Fig. B. In these panels, statistically significant long-term ascents are shown. The warming rates of potential temperature at 800 m, 1000 m and 1200 m depth are 0.16℃, 0.15℃ and 0.12℃ per century, respectively.

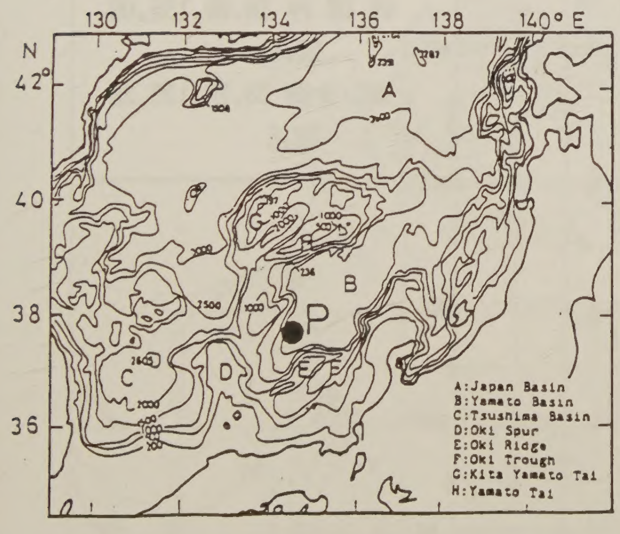


図 A．日本海の海底地形図及び観測点 P の位置

Fig. A. Bottom topography in the Japan Sea, and the location of the Station P.

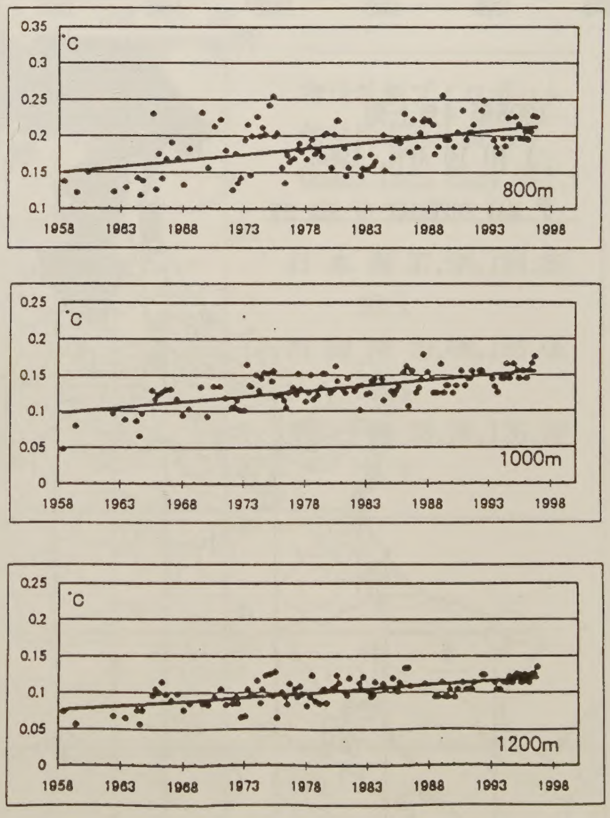
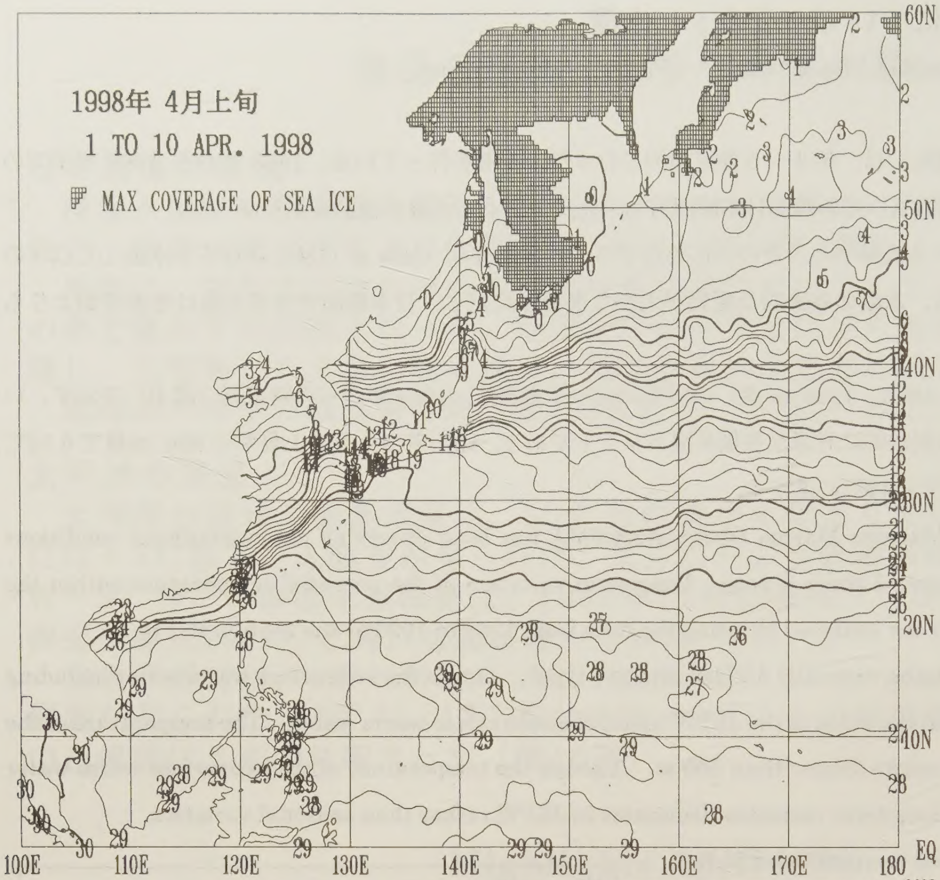
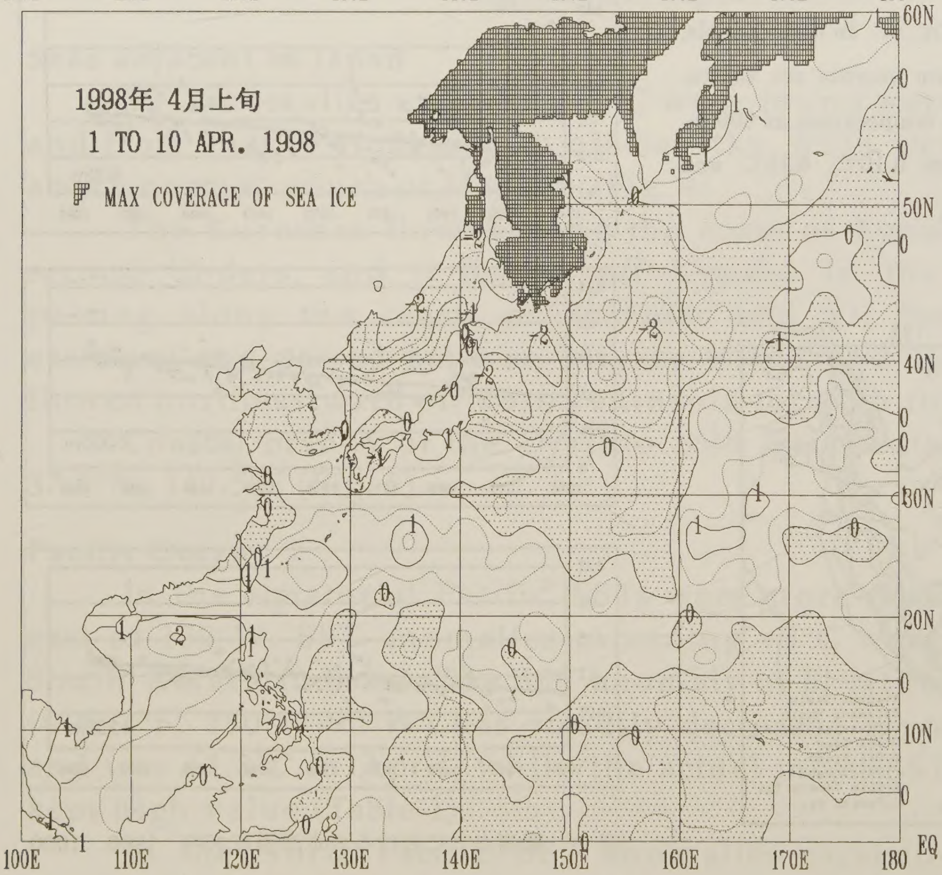


図 B．観測点Ｐにおける日本海固有水内 （800，1000，1200 m 深）のポテンシャル水温の時系列図

Fig. B. Time series of the potential temperature at the depths of 800, 1000 and 1200 m in the Japan Sea Proper Water at Station P.



旬平均沿岸水温(℃) Coastal Water Temperature		
地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	24.6	1.5
御前崎(47655)	14.7	0.5
八丈島(47678)	19.7	1.6
小名浜(47598)	8.1	-1.4
宮　古(47585)	7.0	0.9
江　差(47428)	8.9	-
浜　田(47755)	14.0	-

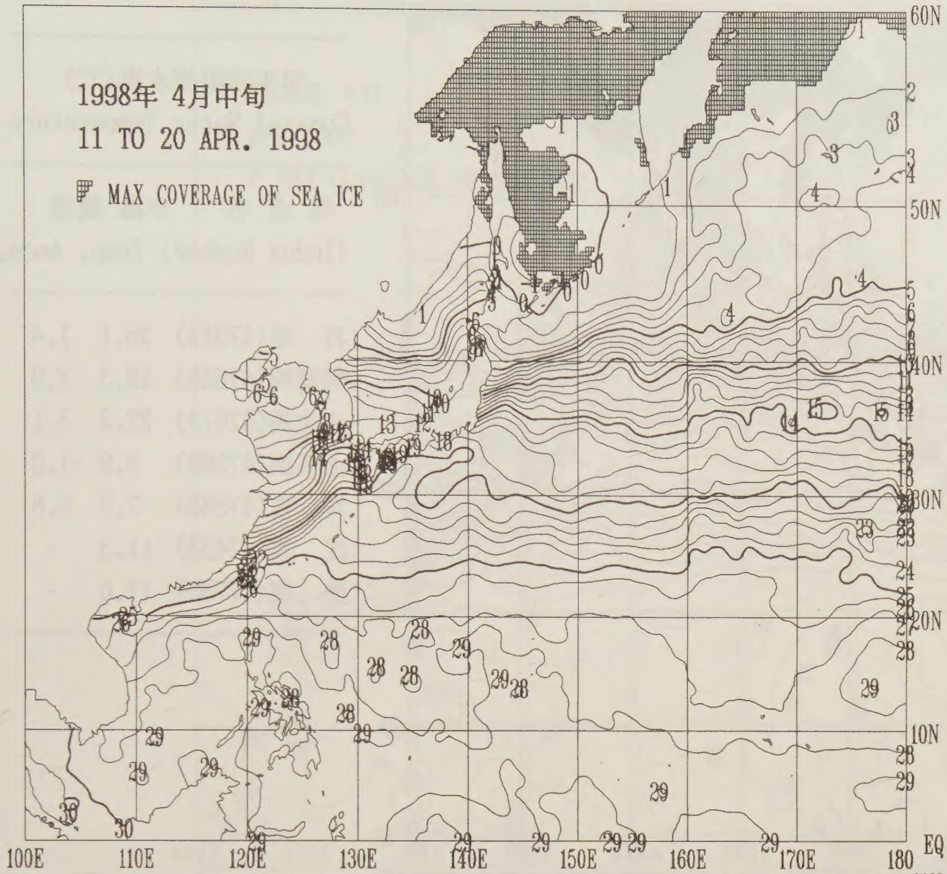


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E 11.8
四国沖	29.0N,135.0E 20.9
東シナ海	28.2N,126.3E 23.6

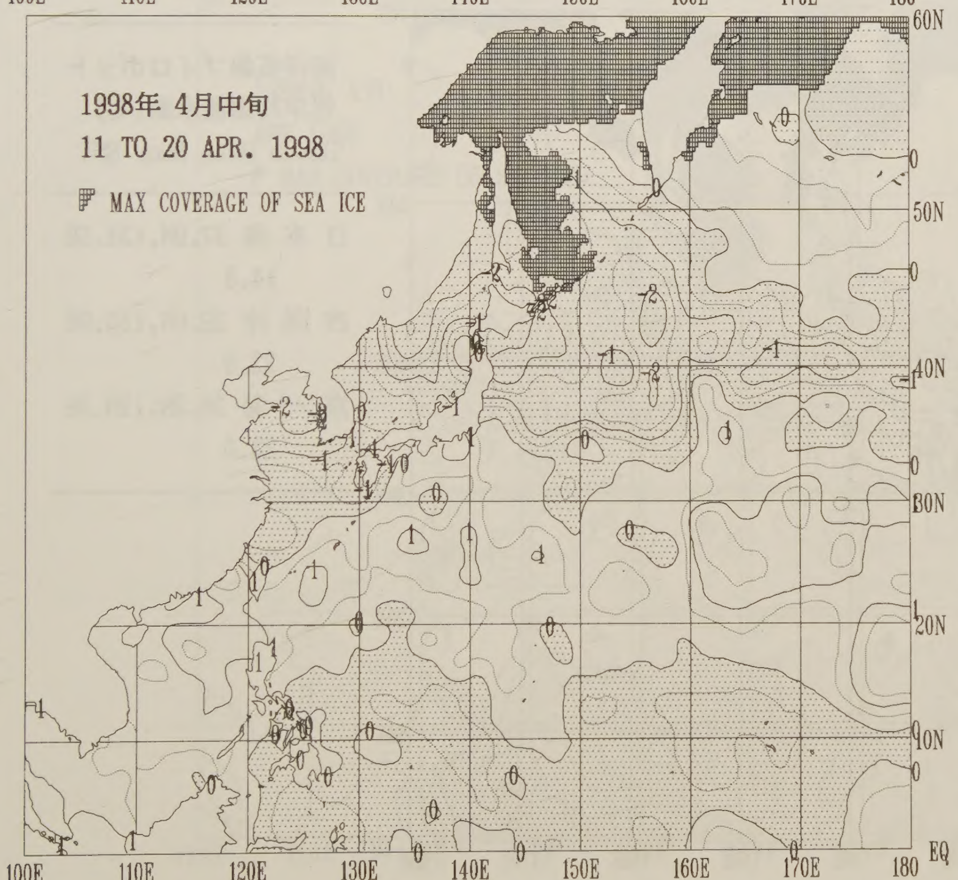
第1図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1998年 4月上旬)

Fig.1 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 1st ten-day period in APR 1998. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃)
Coastal Water Temperature

地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	25.3	1.5
御前崎(47655)	17.1	1.8
八丈島(47678)	21.2	2.3
小名浜(47598)	9.0	-1.4
宮　古(47585)	7.6	1.1
江　差(47428)	9.2	-
浜　田(47755)	15.8	-

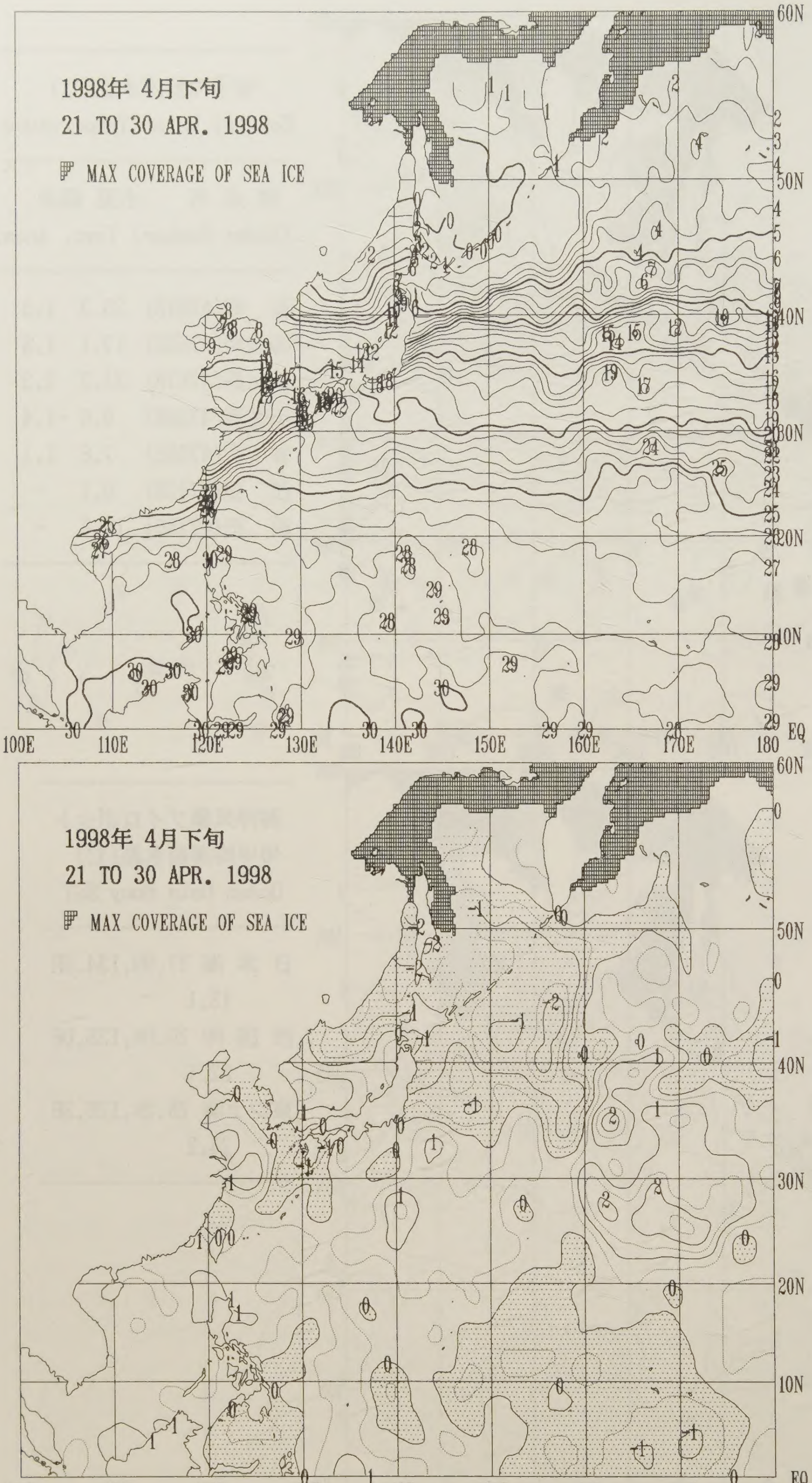


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E
	13.1
四国沖	29.0N,135.0E
	22.1
東シナ海	28.2N,126.3E
	24.2

第2図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1998年 4月中旬)

Fig.2 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 2nd ten-day period in APR 1998. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



第3図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1998年 4月下旬)

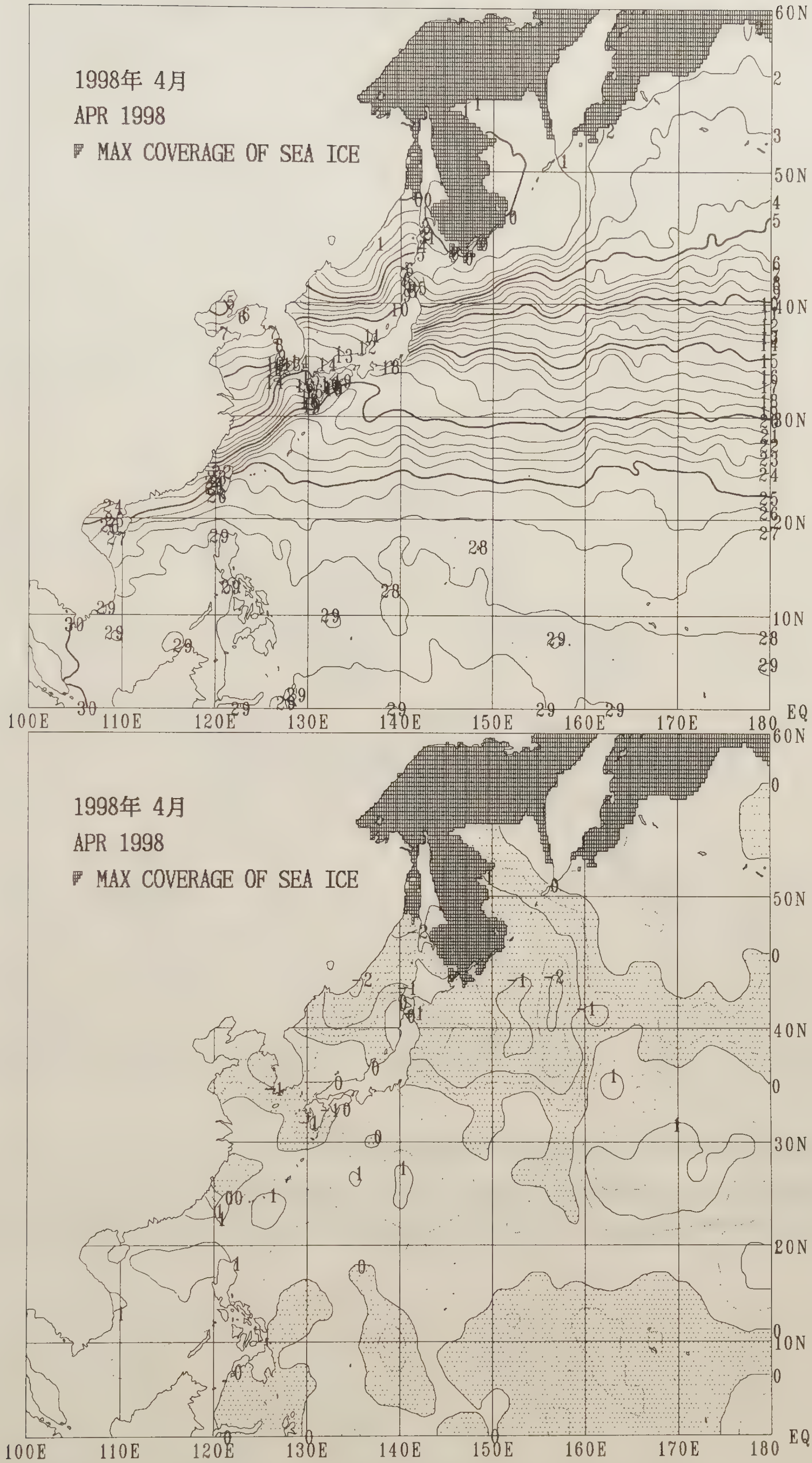
Fig.3 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 3rd ten-day period in APR 1998. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.

旬平均沿岸水温(℃)
Coastal Water Temperature

地 点 名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	26.1	1.4
御前崎(47655)	19.3	2.9
八丈島(47678)	22.3	3.1
小名浜(47598)	9.9	-1.0
宮　古(47585)	7.9	0.8
江　差(47428)	11.3	-
浜　田(47755)	17.0	-

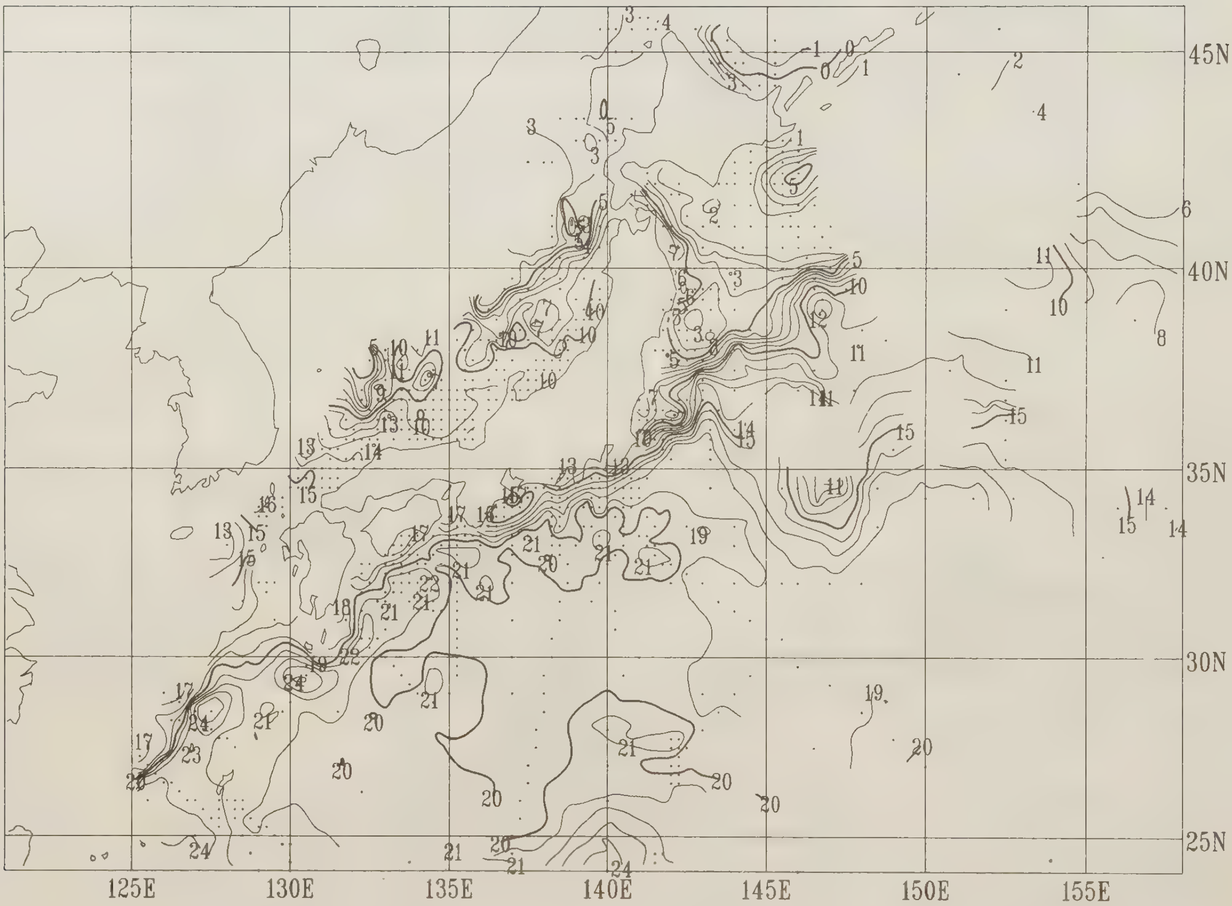
海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日 本 海	37.9N,134.5E	14.8
四 国 沖	29.0N,135.0E	22.9
東シナ海	28.2N,126.3E	23.0



第4図 北西太平洋月平均海面水温図(上)及び偏差図(下)(1998年 4月)

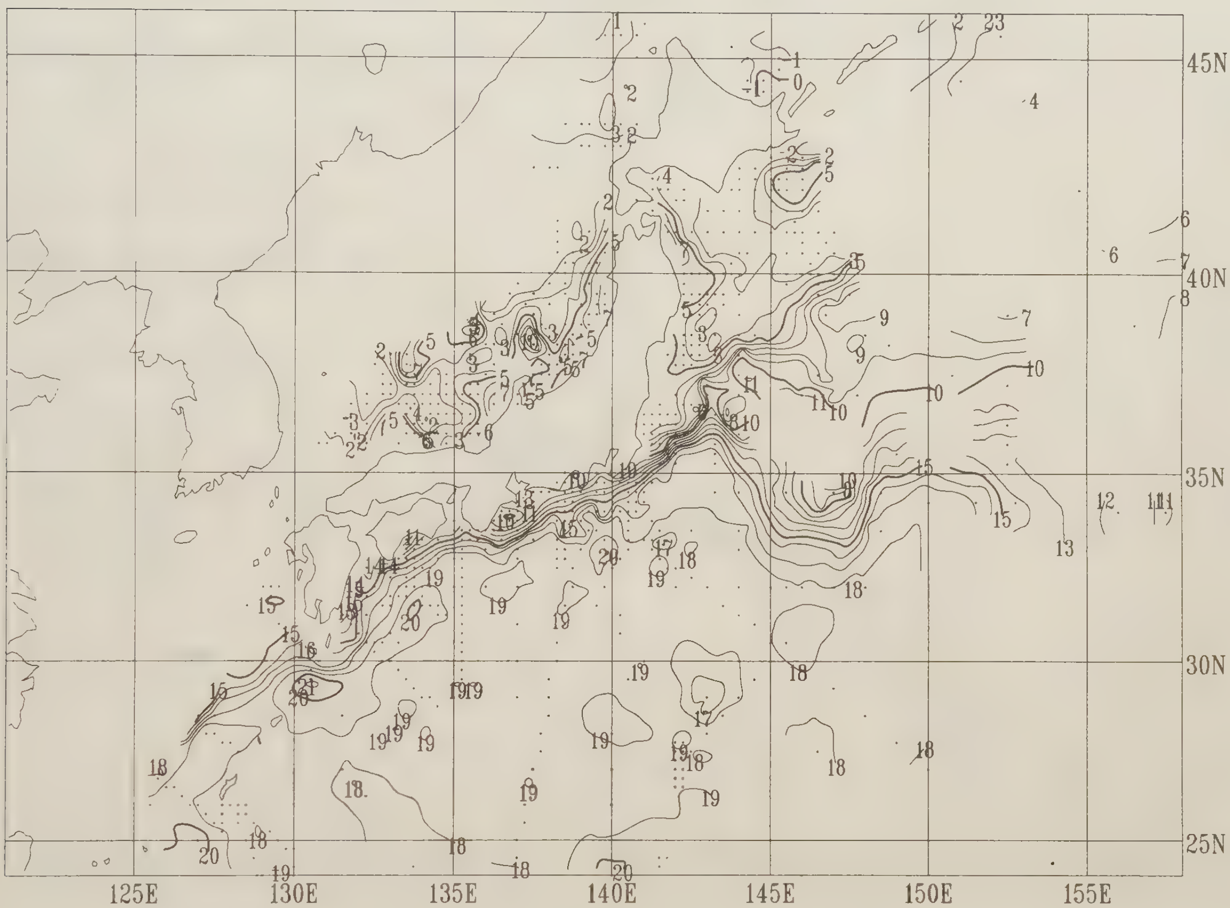
Fig.4 Monthly mean SST (top) and anomalies (bottom) in the western North Pacific for APR 1998. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



第5図　日本近海表層水温図(深さ100m)(1998年 4月)

Fig.5 Subsurface (100m) temperatures in the seas adjacent to Japan for APR 1998. Contour interval is 1°C. Observation points are denoted by dots.

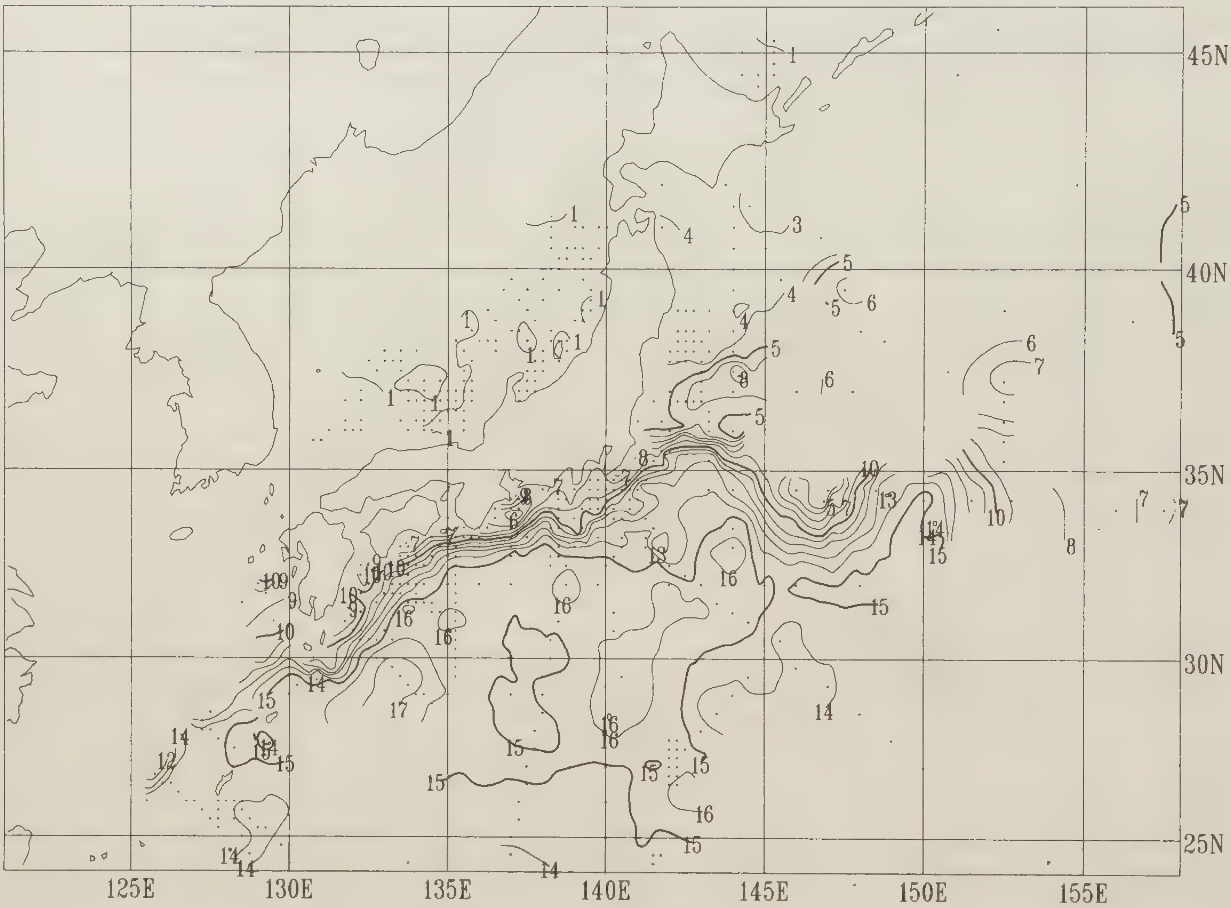
200m Temperatures in the Seas Adjacent to Japan



第6図　日本近海表層水温図(深さ200m)（1998年 4月）

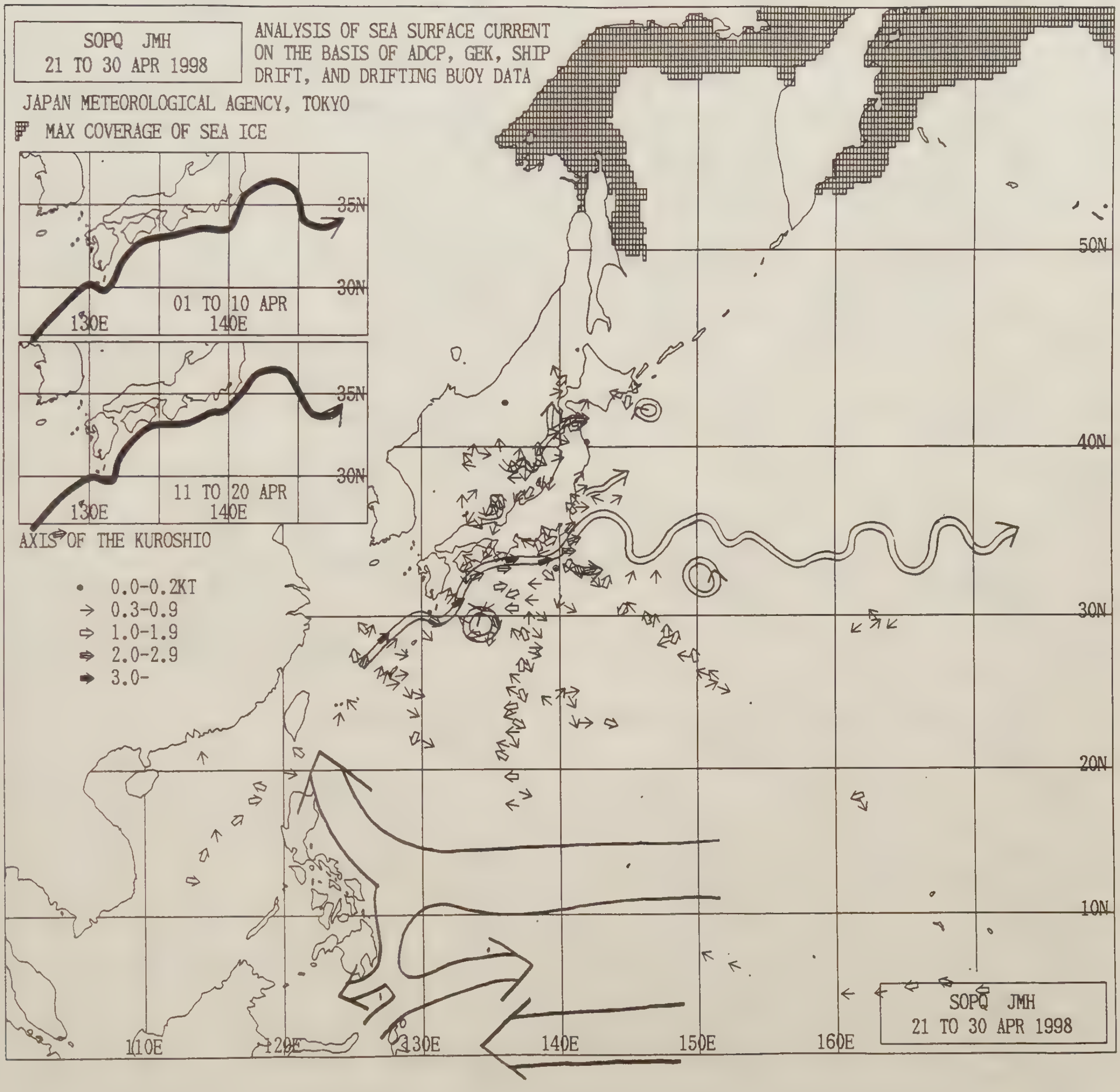
Fig.6 Subsurface (200m) temperatures in the seas adjacent to Japan for APR 1998. Contour interval is 1°C. Observation points are denoted by dots.

400m Temperatures in the Seas Adjacent to Japan



第7図　日本近海表層水温図(深さ400m) (1998年 4月)

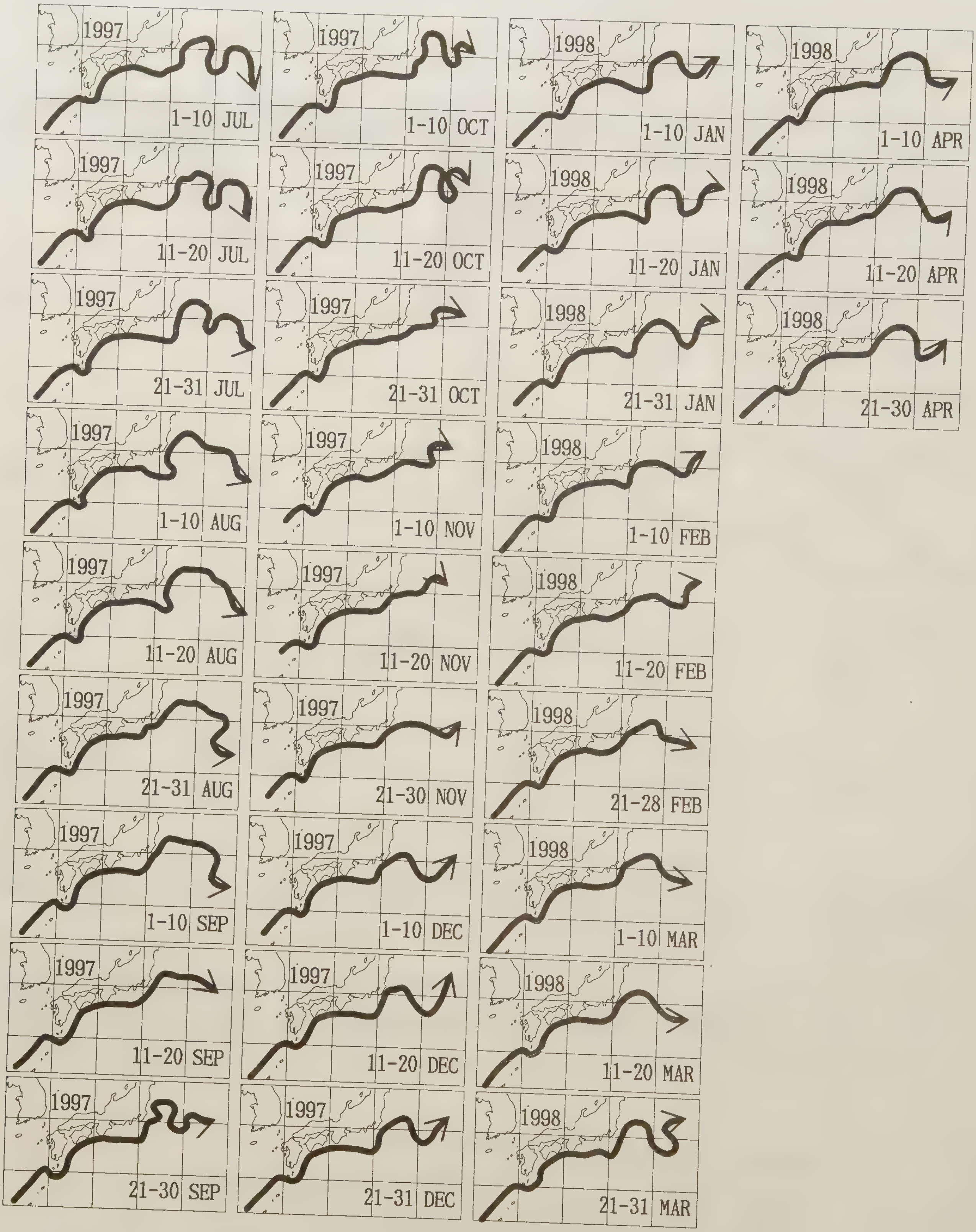
Fig.7 Subsurface (400m) temperatures in the seas adjacent to Japan for APR 1998. Contour interval is 1°C. Observation points are denoted by dots.



第8図　北西太平洋海流図（1998年 4月下旬）

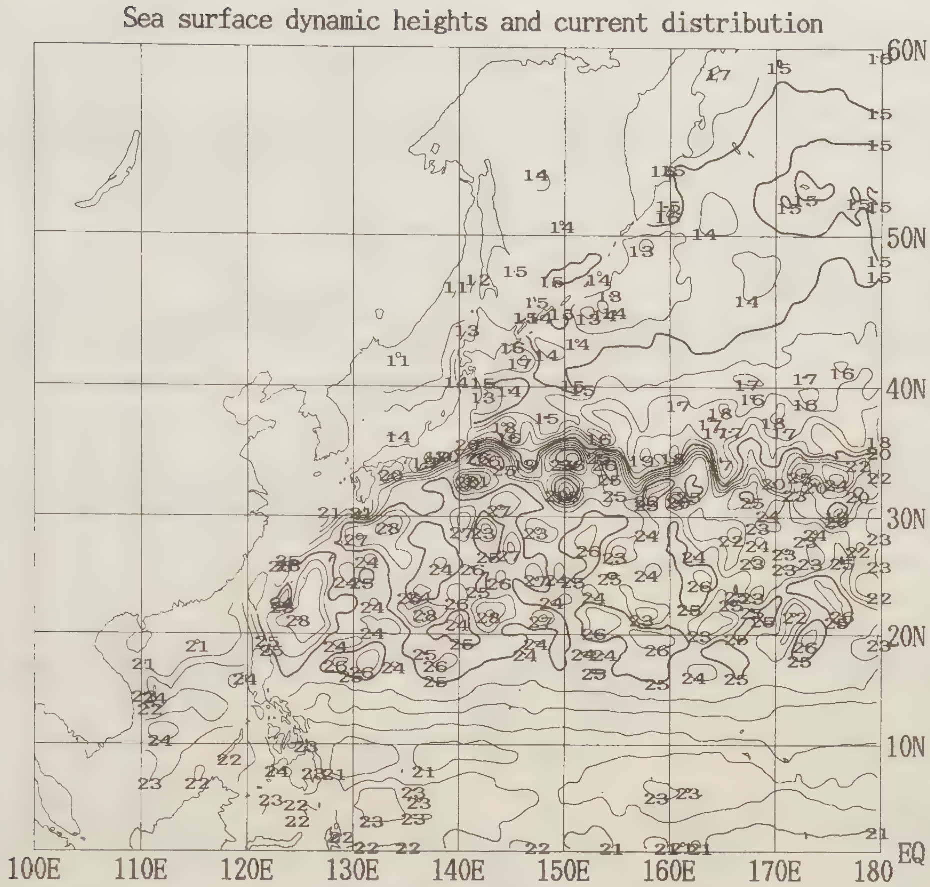
Fig.8 Analysis of the sea surface current in the western North Pacific for the 3rd ten-day period in APR 1998. Small arrows indicate in situ observations. Major currents such as the Kuroshio and the North Equatorial Current are denoted by larger open arrows.

Location of the Kuroshio axis



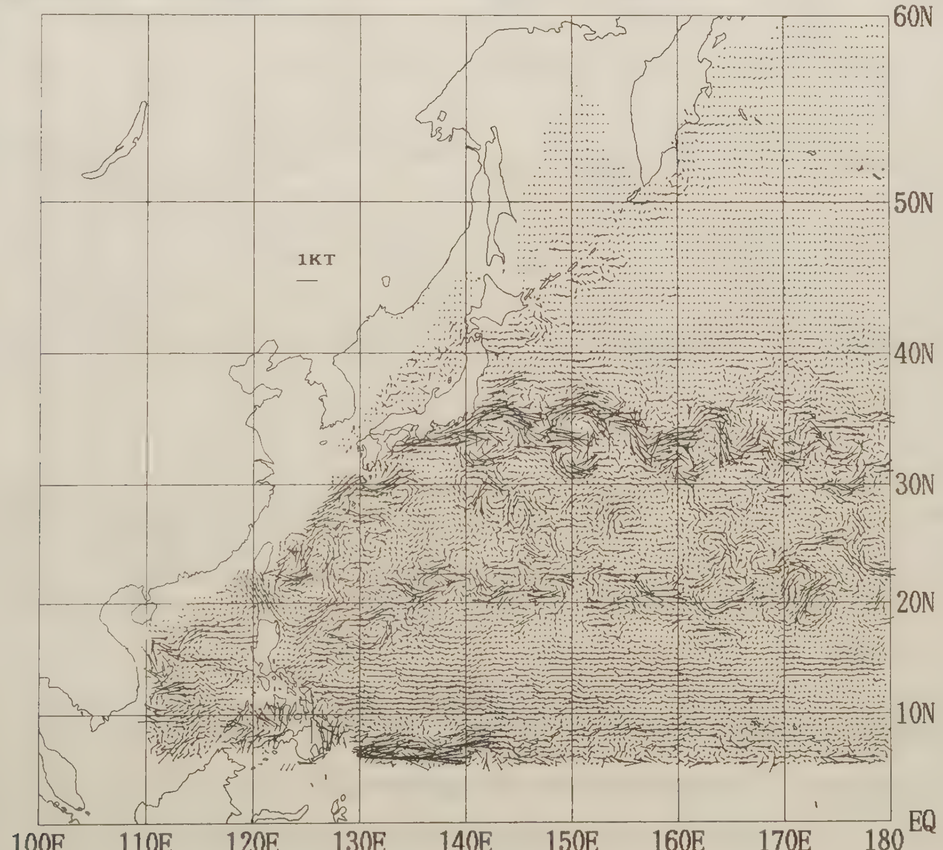
第9図 旬別黒潮流軸図

Fig.9 Location of the Kuroshio axis



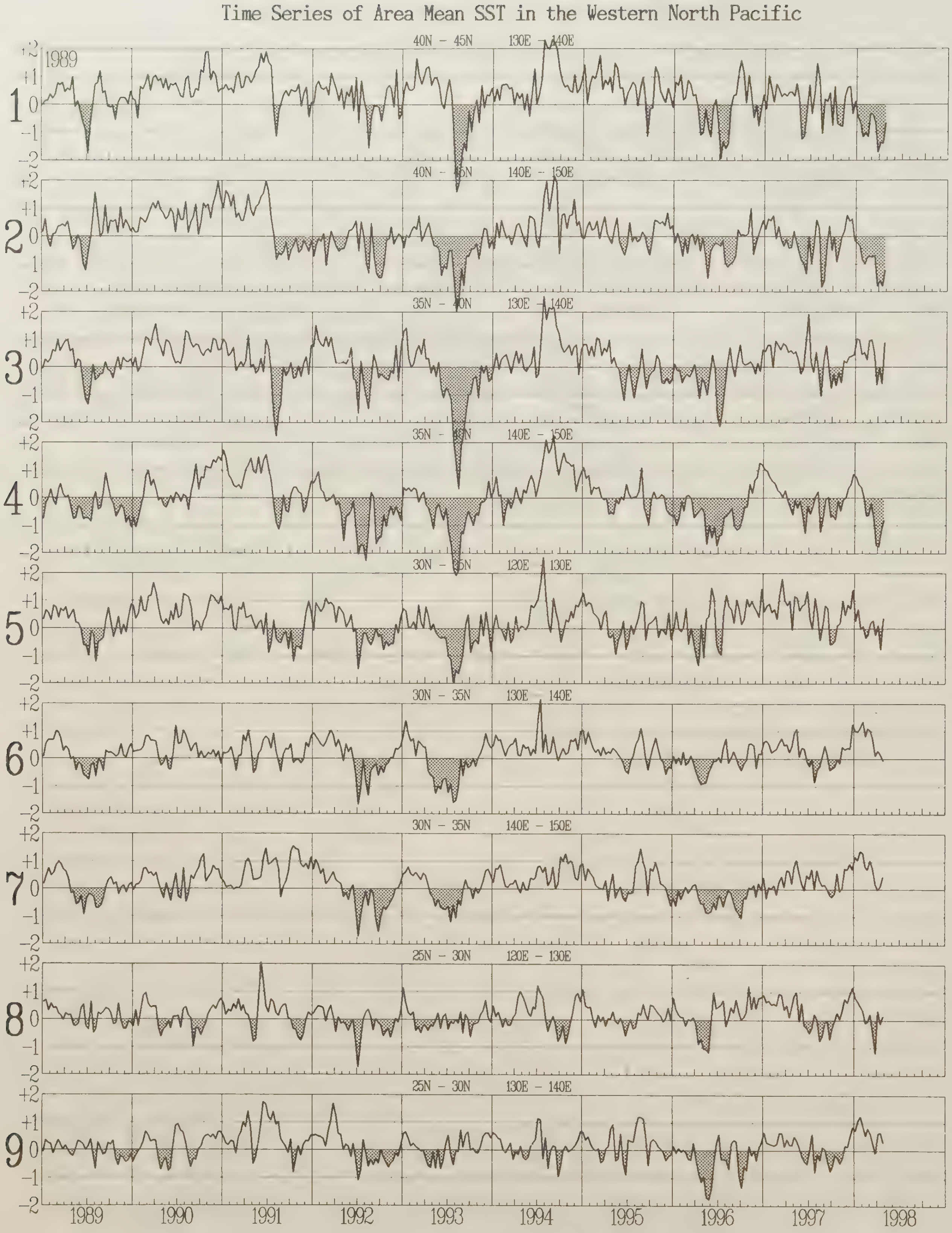
第10図 北西太平洋力学的海面高度分布図(1998年 4月22日)

Fig.10 Sea surface dynamic heights (10cm) in the western North Pacific derived from the altimeter data of TOPEX/POSEIDON (APR 22, 1998).
1500db surface is assumed to be the surface of no motion.



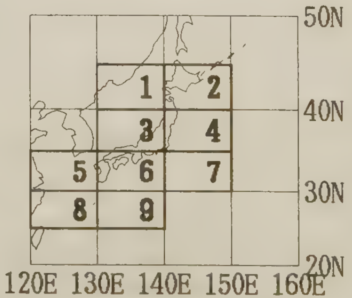
第11図 北西太平洋海流ベクトル図(1998年 4月22日)

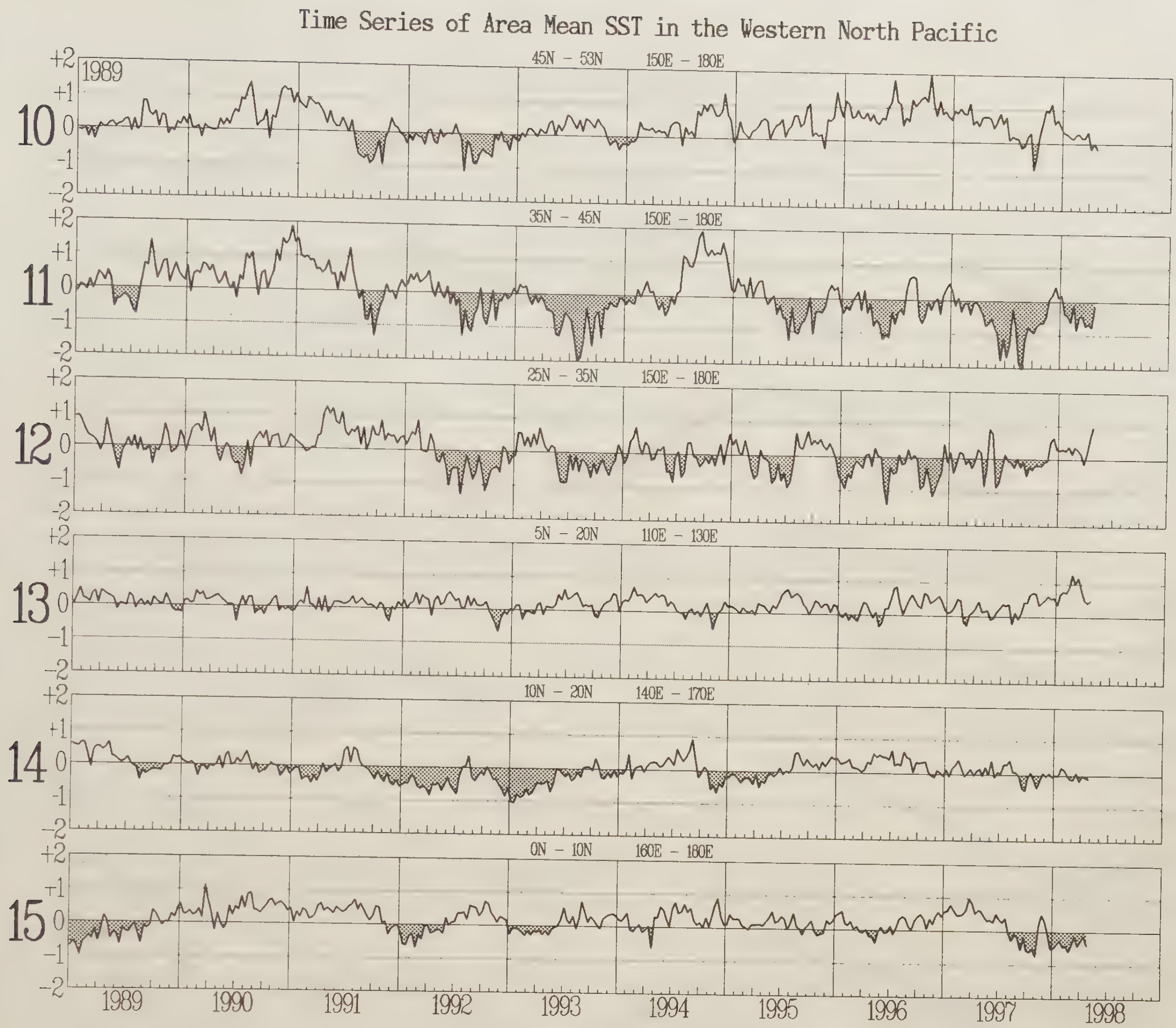
Fig.11 Sea surface current vectors in the western North Pacific (APR 22, 1998).
Vectors are derived from the sea surface dynamic heights from TOPEX/POSEIDON and subsurface temperature distribution assuming the geostrophic relation.



第12図　海域別旬平均海面水温平年偏差時系列図

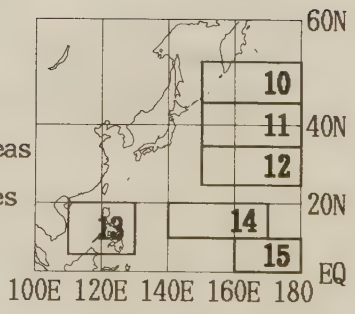
Fig.12 Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).

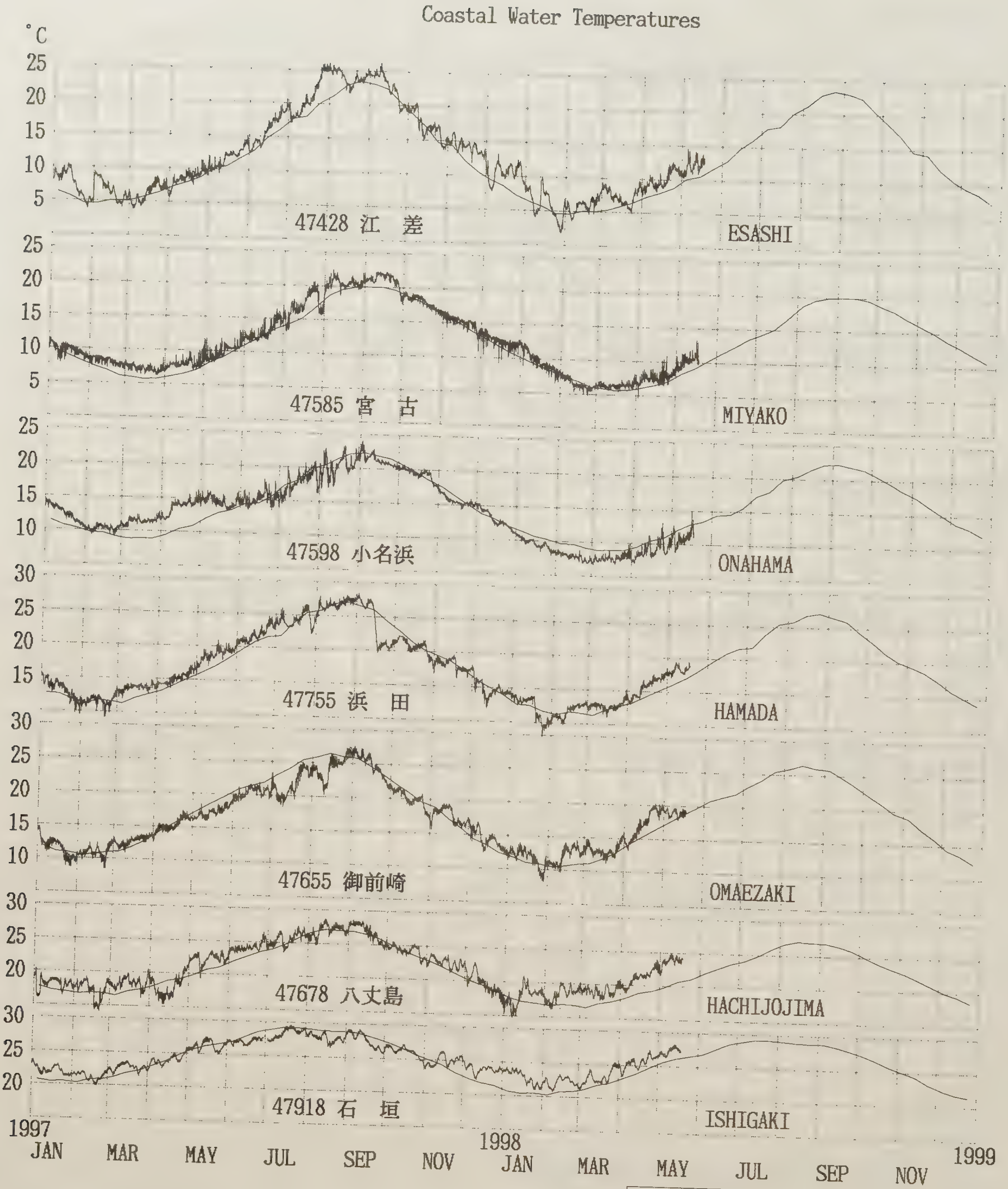


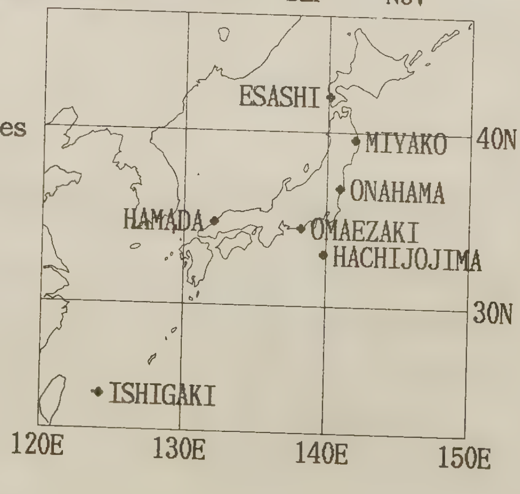


第12図　海域別旬平均海面水温平年偏差時系列図（つづき）

Fig.12 (continue) Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).



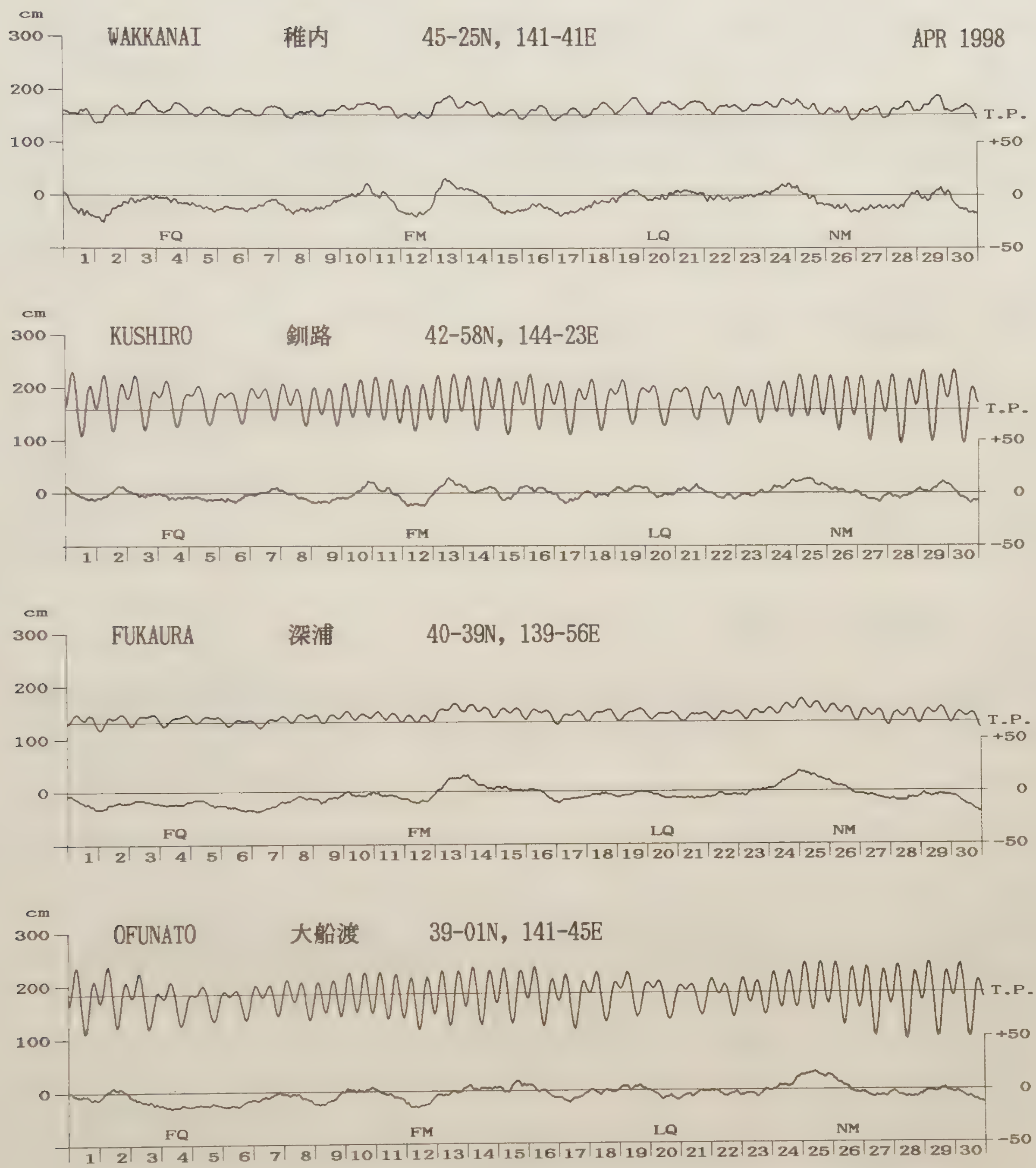




第13図 沿岸水温時系列図

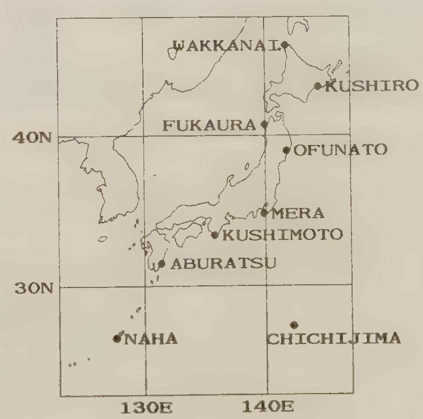
Fig.13 Time series of hourly coastal water temperatures (°C) measured at 7 coastal stations of the JMA shown in the right panel.
Thin lines show ten-day mean climatology.

Time Series of Sea Level

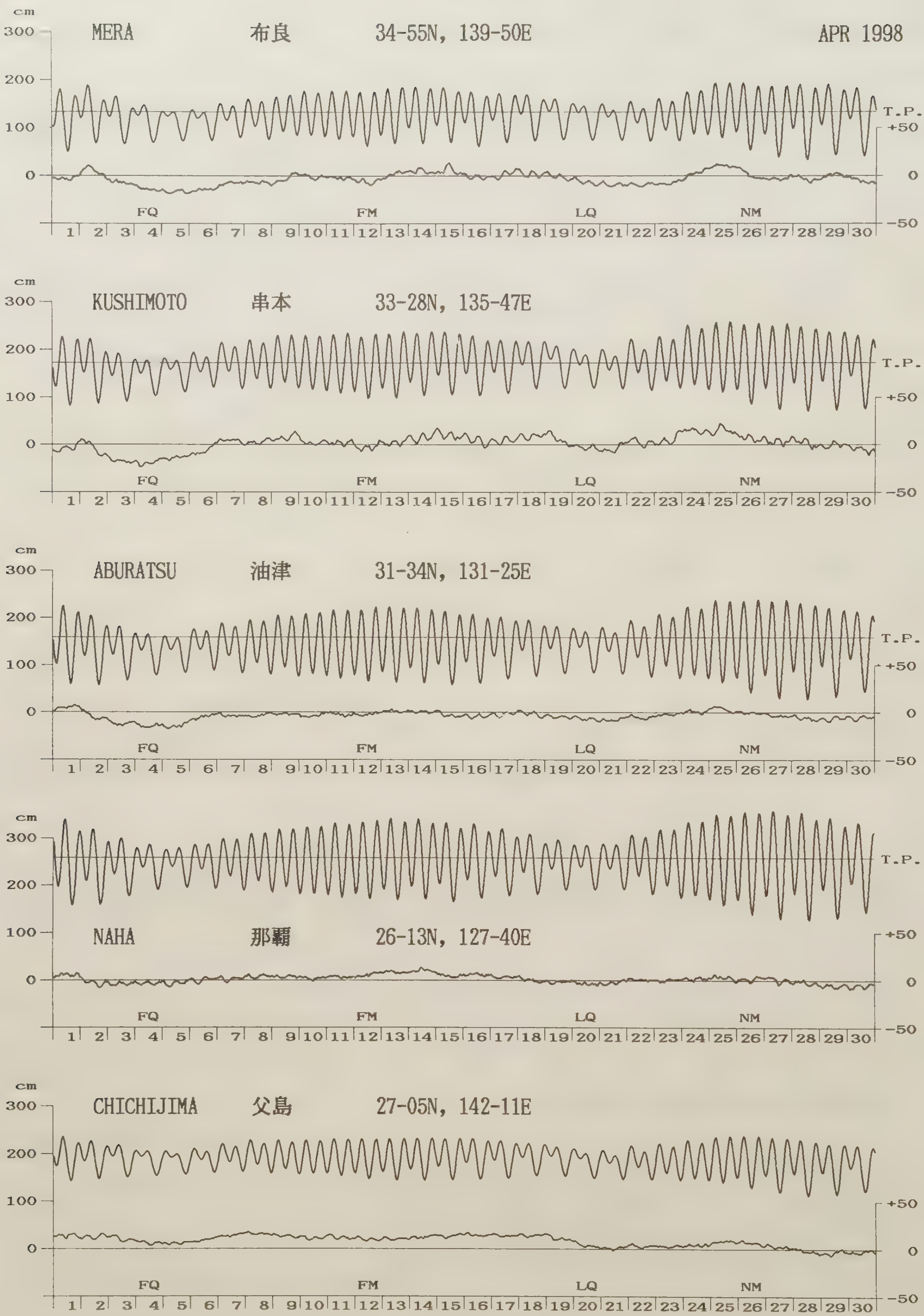


第14図 沿岸潮位時系列図（1998年 4月）

Fig.14 Time series of hourly sea level observation (upper line) and its anomalies (lower line) at 9 stations of the JMA in the right panel.
Short term variations are removed from raw data.

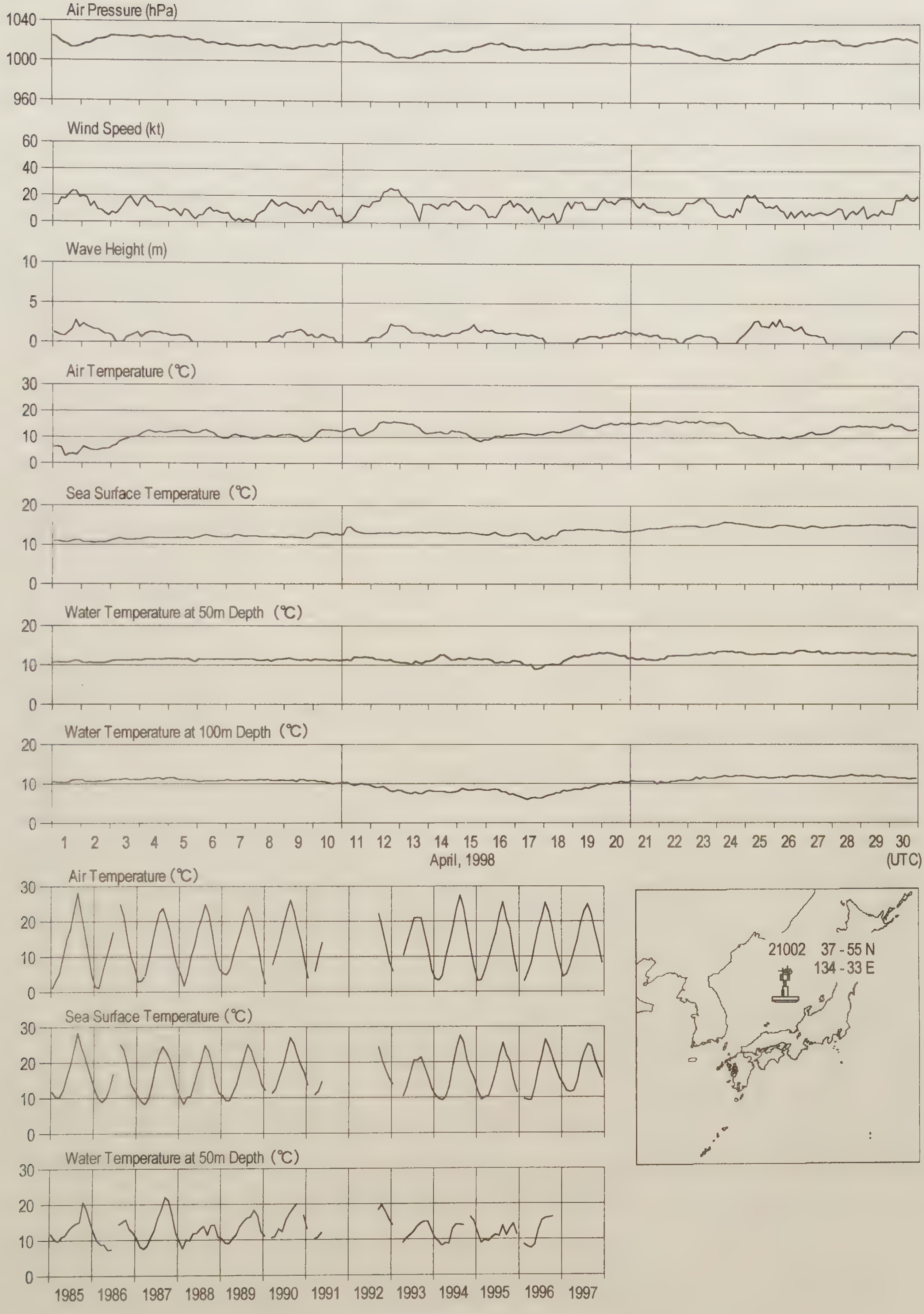


FM: full moon, FQ: first quarter
NM: new moon, LQ: last quarter
T.P.: Mean sea level of Tokyo Bay (Tokyo Peil)



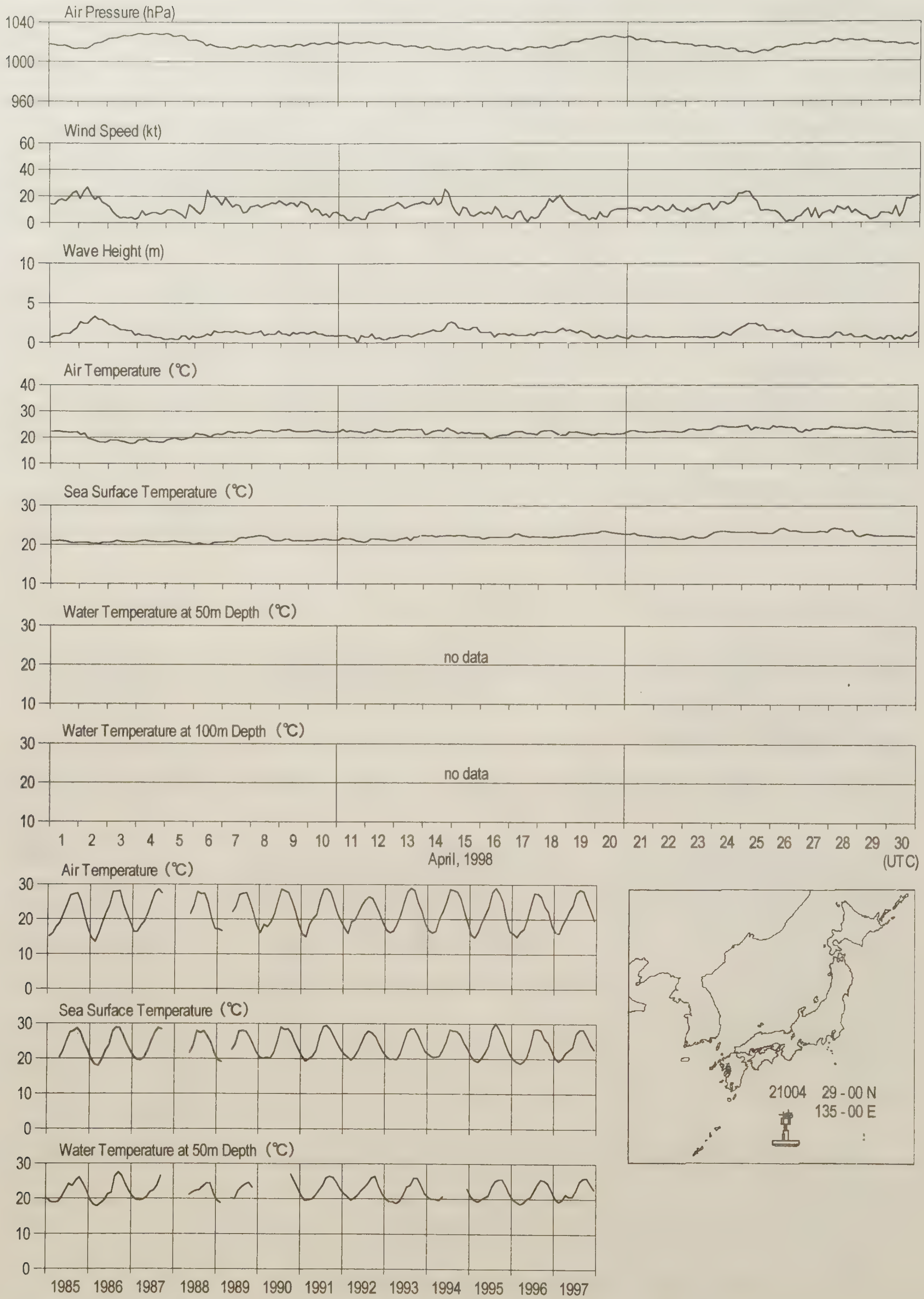
第14図 つづき

Fig.14 continue



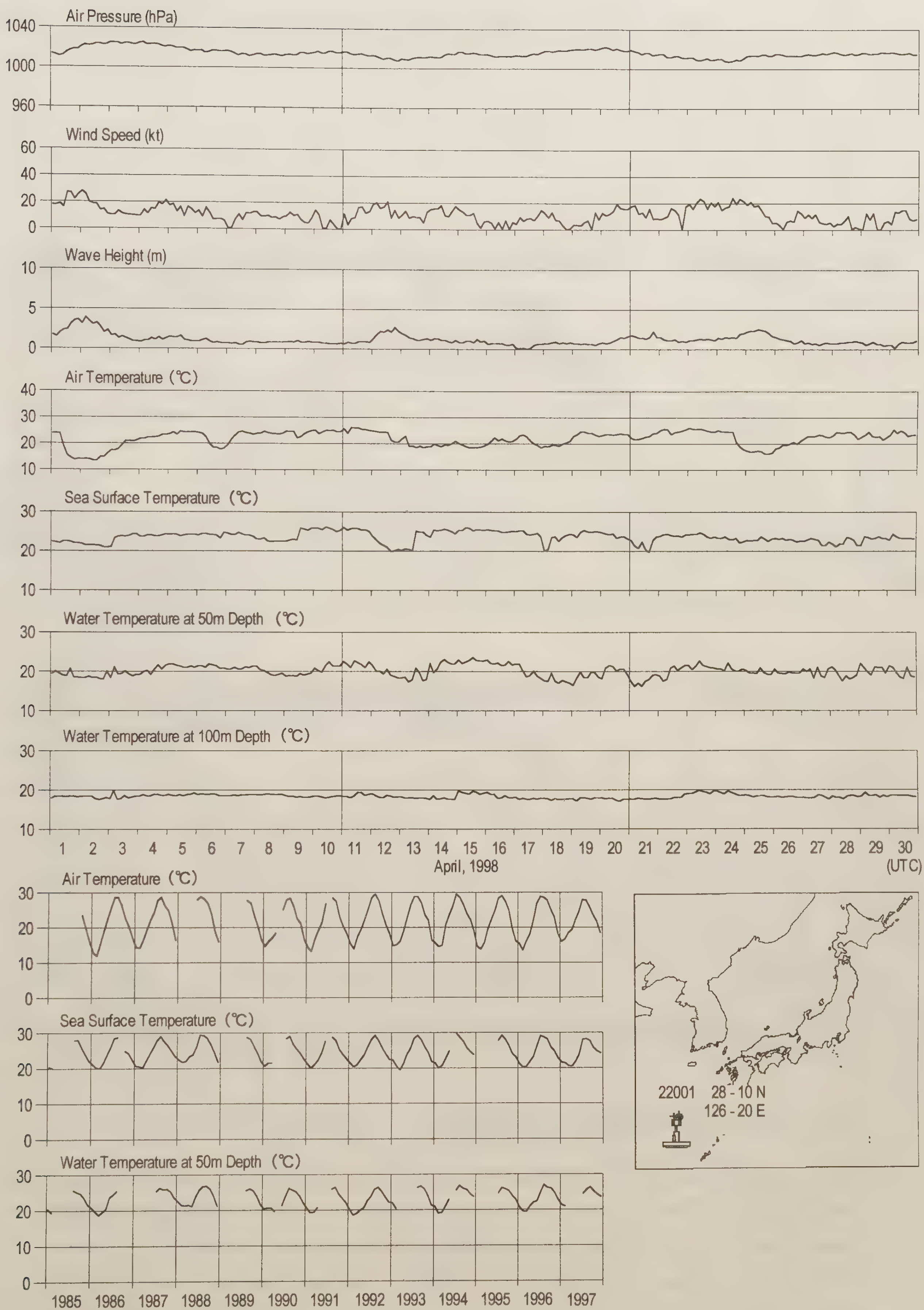
第15図　海洋気象ブイロボットによる観測要素の時系列図（日本海：21002）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the Japan Sea (WMO ID No. 21002). The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



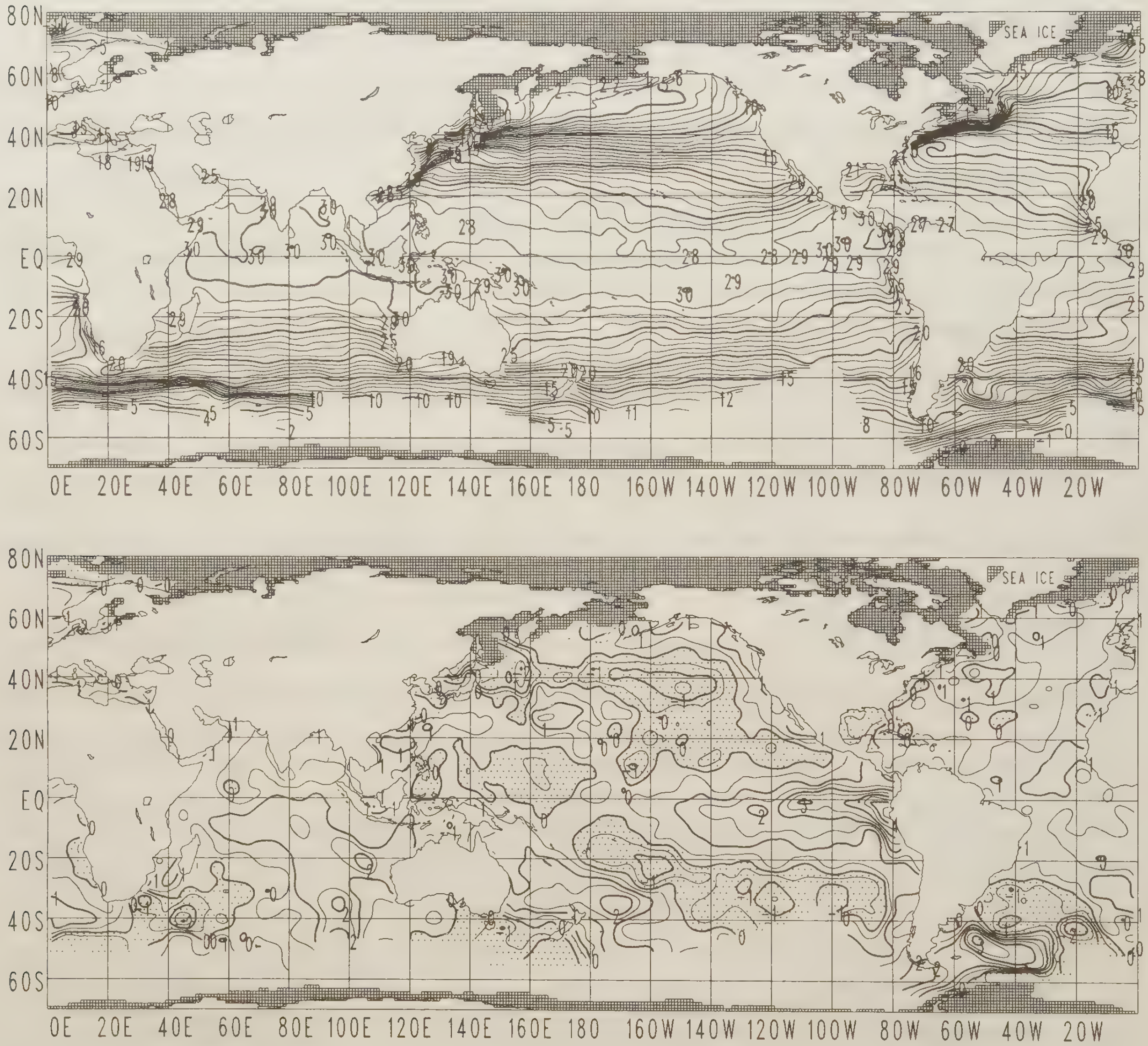
第15図　海洋気象ブイロボットによる観測要素の時系列図（四国沖：21004）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation south of Shikoku (WMO ID No. 21004).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



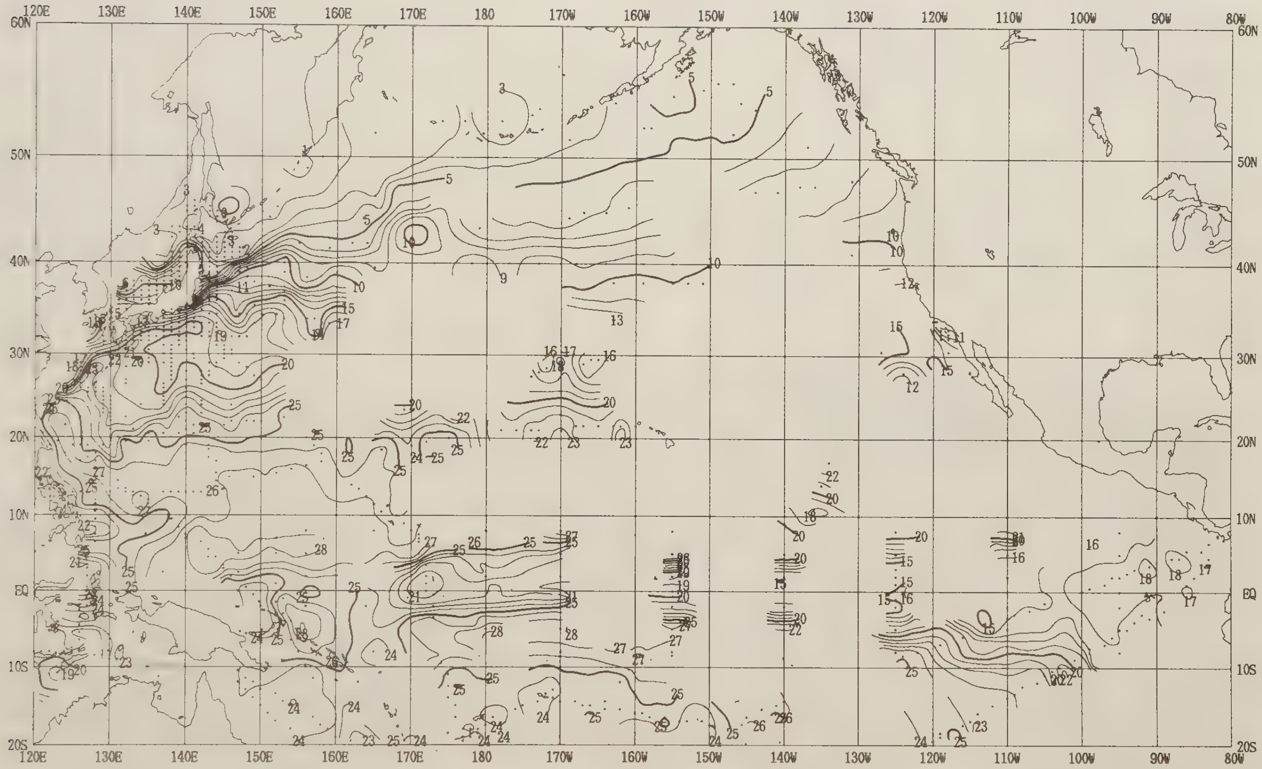
第15図　海洋気象ブイロボットによる観測要素の時系列図（東シナ海：22001）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the East China Sea (WMO ID No. 22001).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



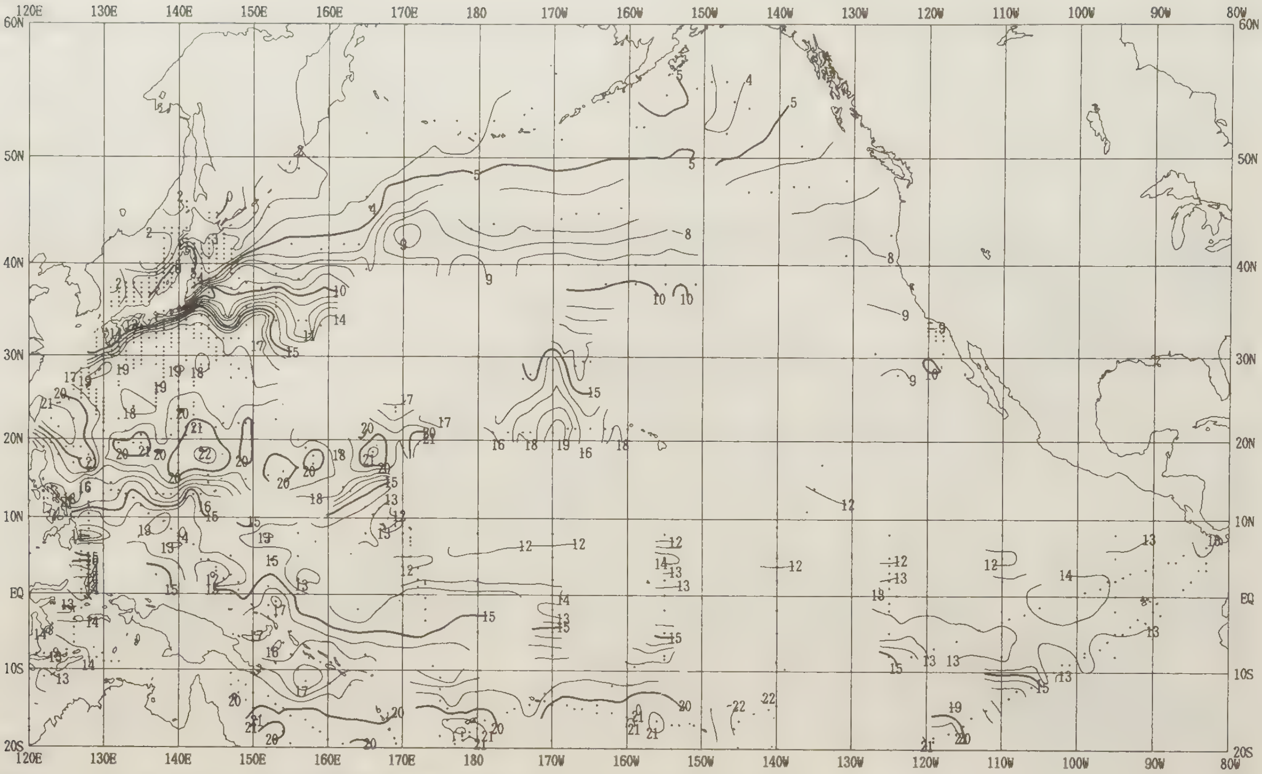
第16図　全球月平均海面水温図（上）及び偏差図（下）（1998年 4月）

Fig.16 Monthly mean sea surface temperature over the global ocean (top) and anomalies (bottom) for APR 1998. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C (top) and additional anomaly contours of ±0.5°C are shown by thin lines. Negative anomalies are spotted. Maximum coverage of sea ice is shaded. Data sources for sea ice are U.S. National Ice Center (polar regions) and JMA (the Sea of Okhotsk).



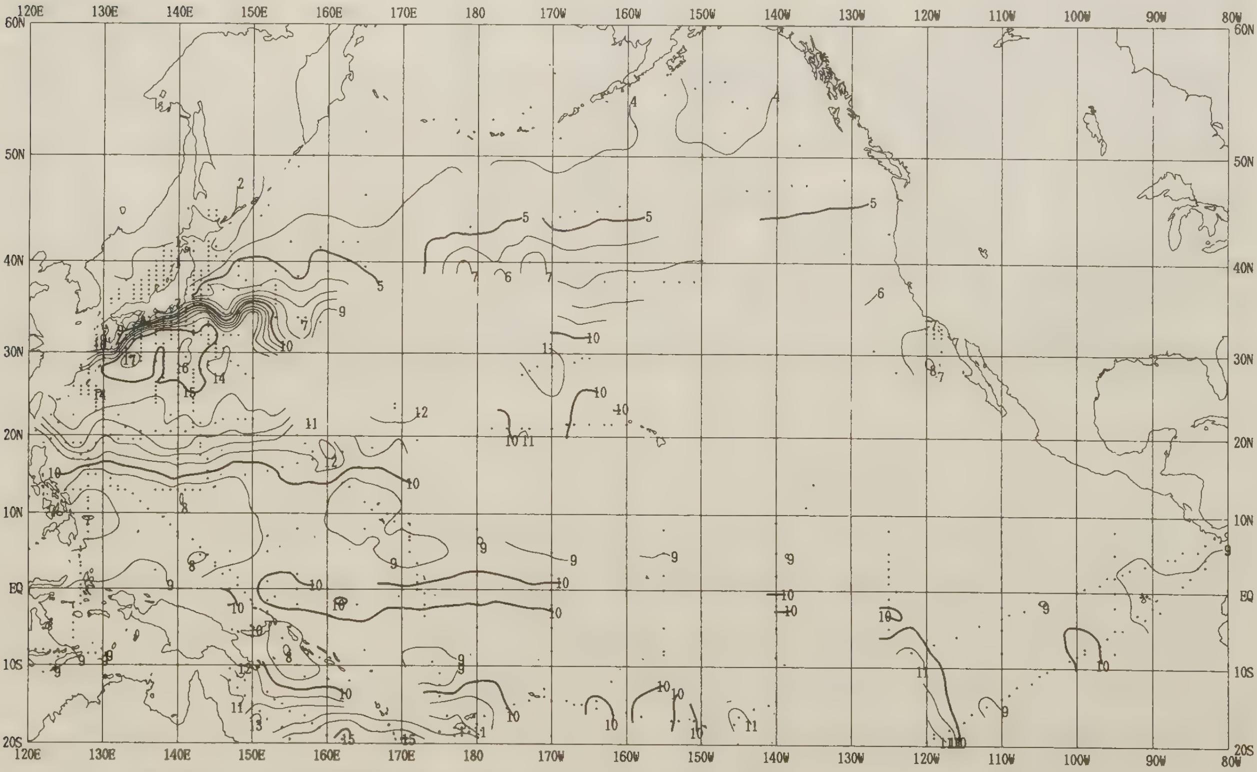
第17図　太平洋表層水温図(深さ100m) (1998年 4月)

Fig.17 Subsurface (100m) temperatures in the Pacific Ocean for APR 1998. Contour interval is 1°C. Observation points are denoted by dots.



第18図　太平洋表層水温図(深さ200m) (1998年 4月)

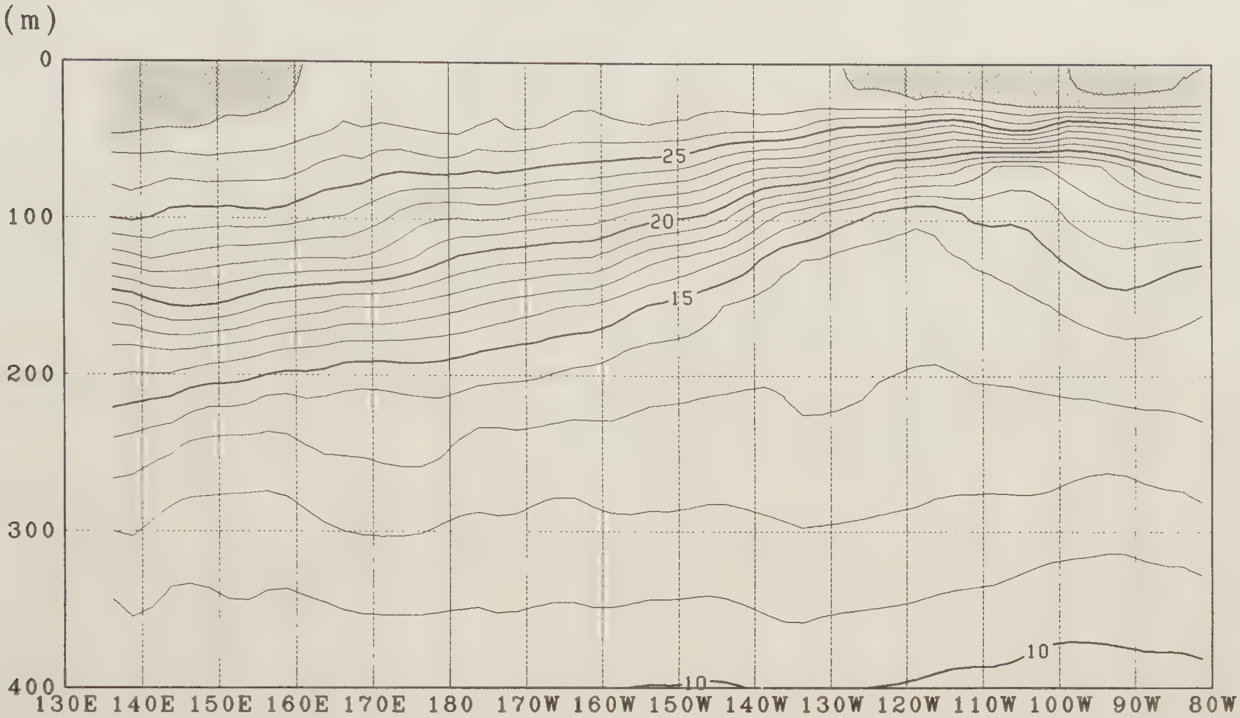
Fig.18 Subsurface (200m) temperatures in the Pacific Ocean for APR 1998. Contour interval is 1°C. Observation points are denoted by dots.

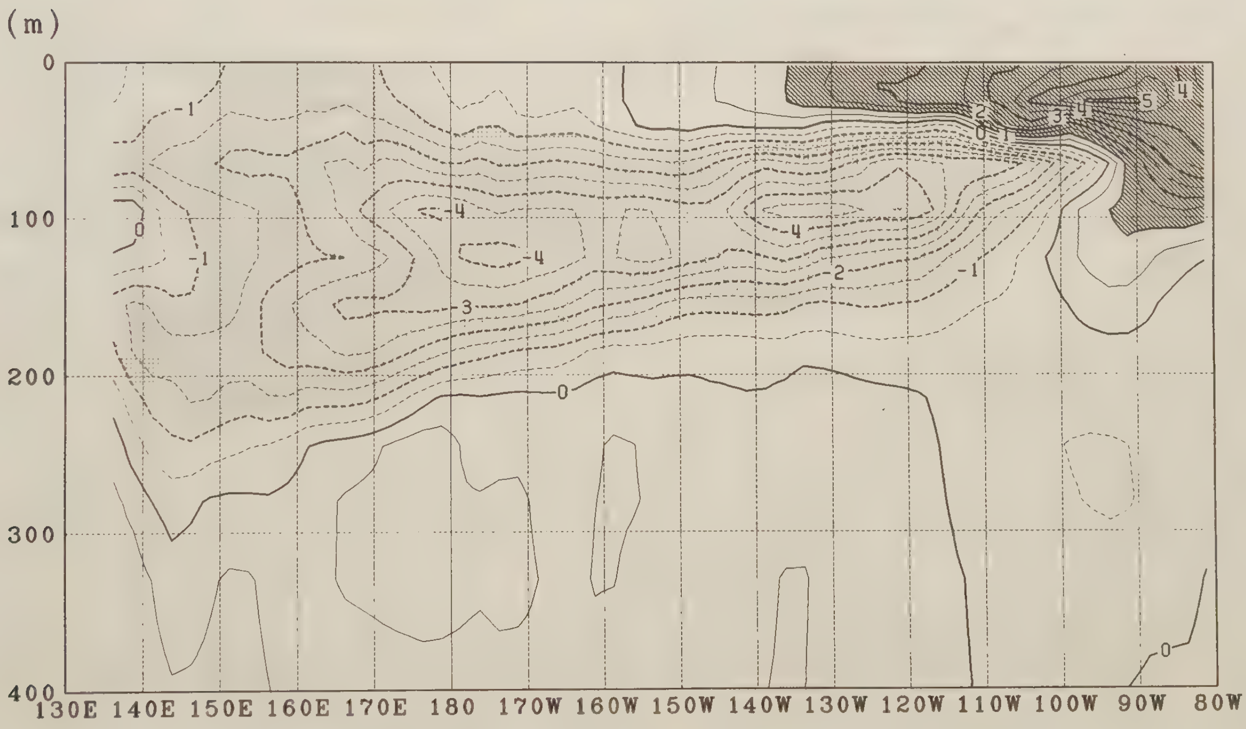


第19図　太平洋表層水温図(深さ400m) (1998年 4月)

Fig.19 Subsurface (400m) temperatures in the Pacific Ocean for APR 1998. Contour interval is 1°C. Observation points are denoted by dots.

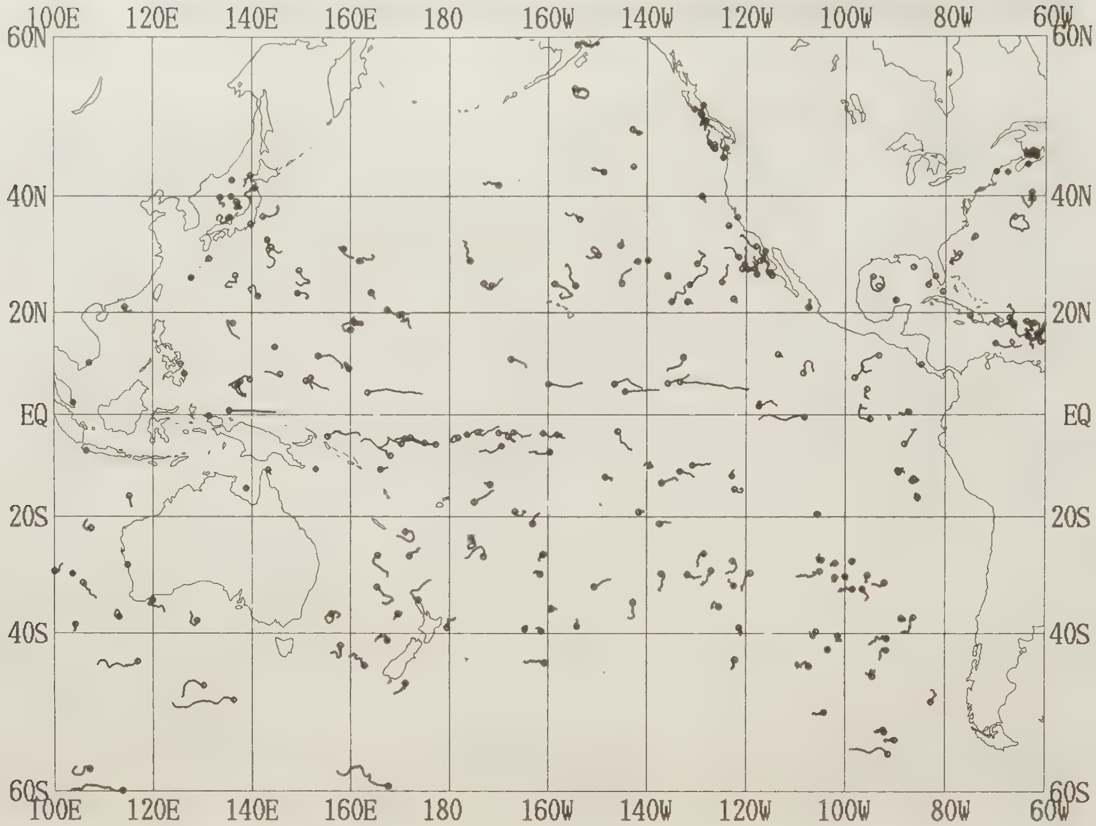
Depth-Longitude Sections of Equatorial Temperature & Anomalies





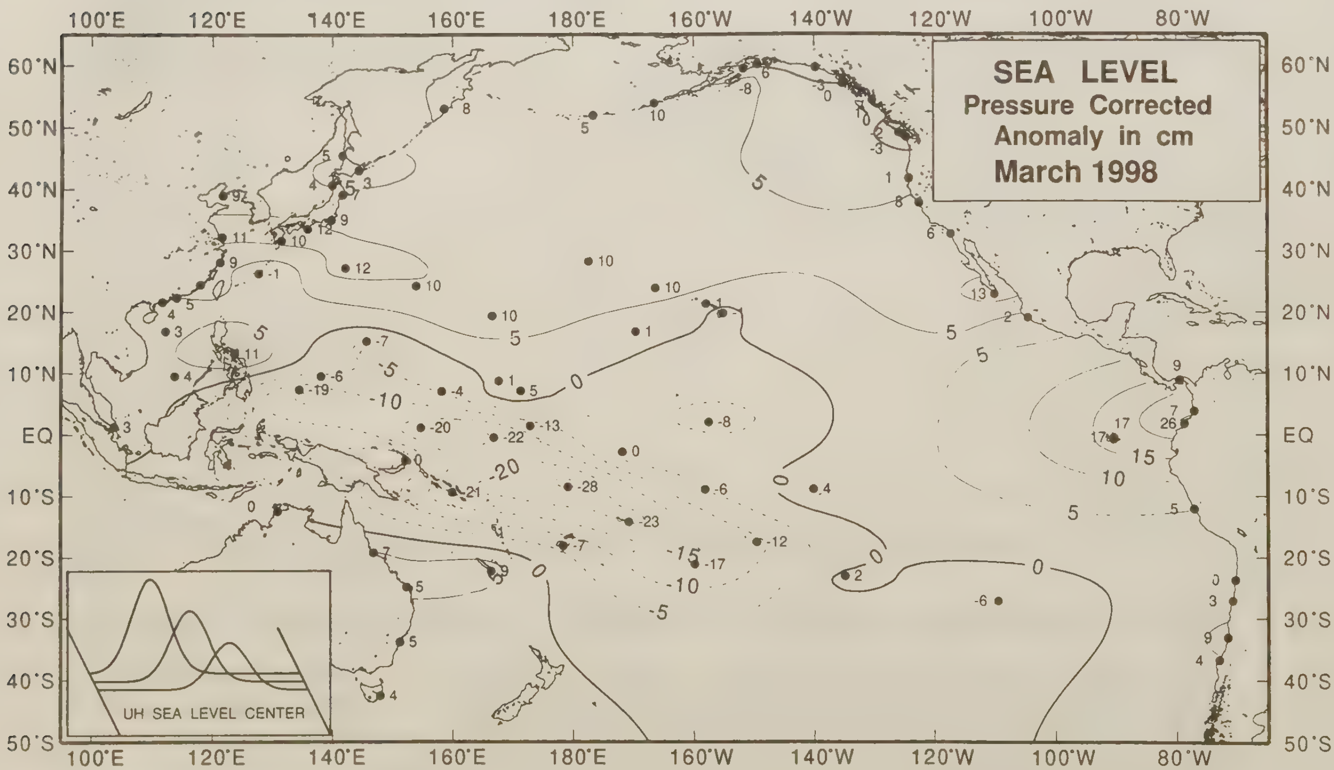
第20図　太平洋赤道に沿う表層水温（上）及び偏差（下）の深度－経度断面図（1998年 4月）

Fig.20 Depth-longitude sections of temperature (top) and anomalies (bottom) along the equator in the Pacific Ocean for APR 1998. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (top) and 0.5°C (bottom). Values greater than 28°C in the top panel are shaded. In the bottom panel, values greater than 1°C are shaded and values less than -1°C are spotted. Anomalies are computed from 1987-1996 base period means.



第21図　太平洋ブイ流跡図(1998年 4月)

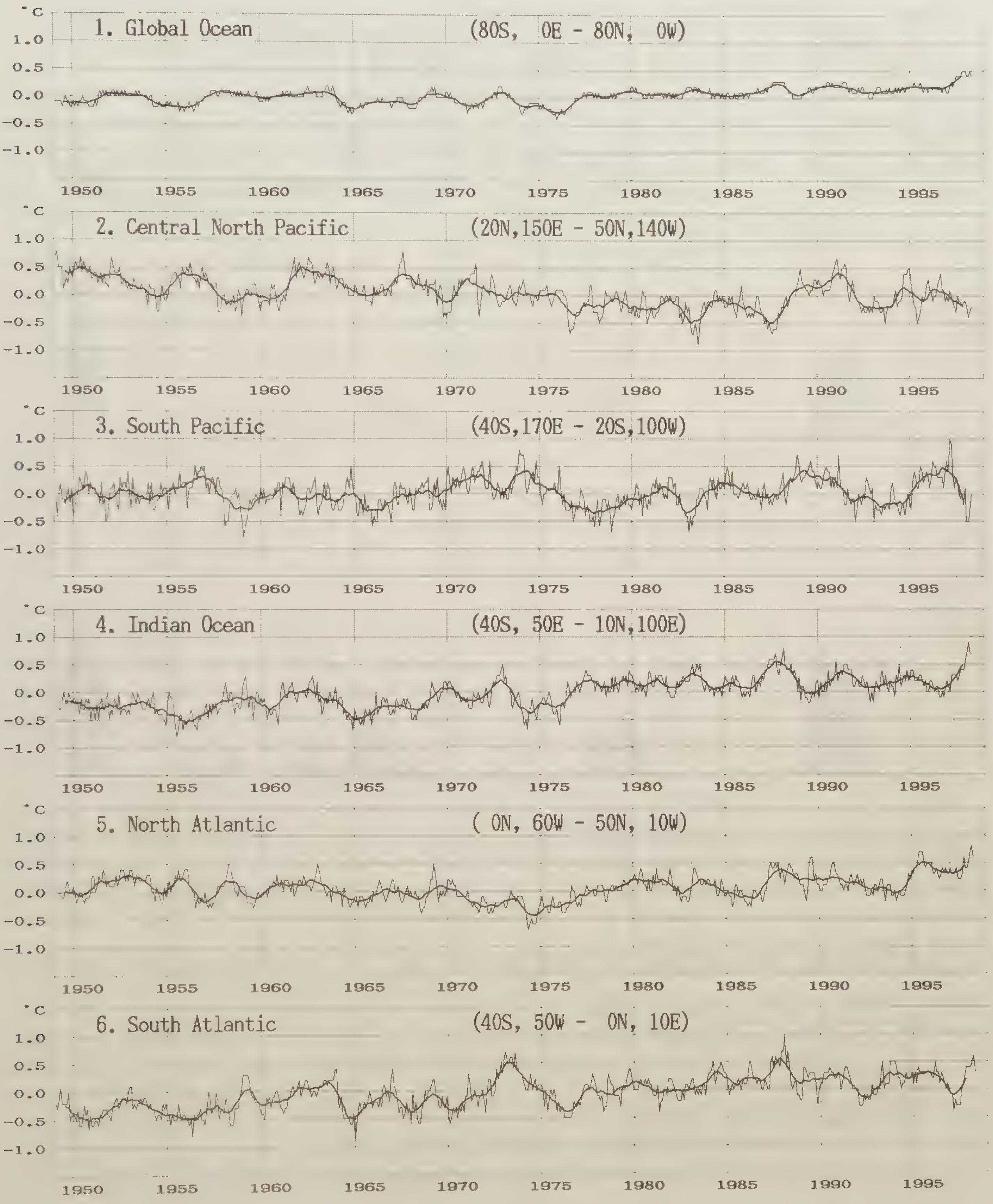
Fig.21 Movements of drifting buoys in the Pacific Ocean during APR 1998.
Each track is for one buoy. Small circles represent last positions for the month.



第22図　太平洋海面水位偏差図 (1998年 3月)

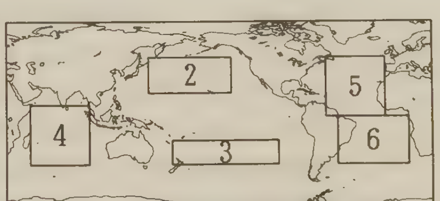
Fig.22 Monthly sea level anomalies for MAR 1998 obtained from mean sea level (1975-1995) adjusted for atmospheric pressure. This figure is prepared by the SOC of ISLP-PAC, Dept. of Oceanography, Univ. of Hawaii.

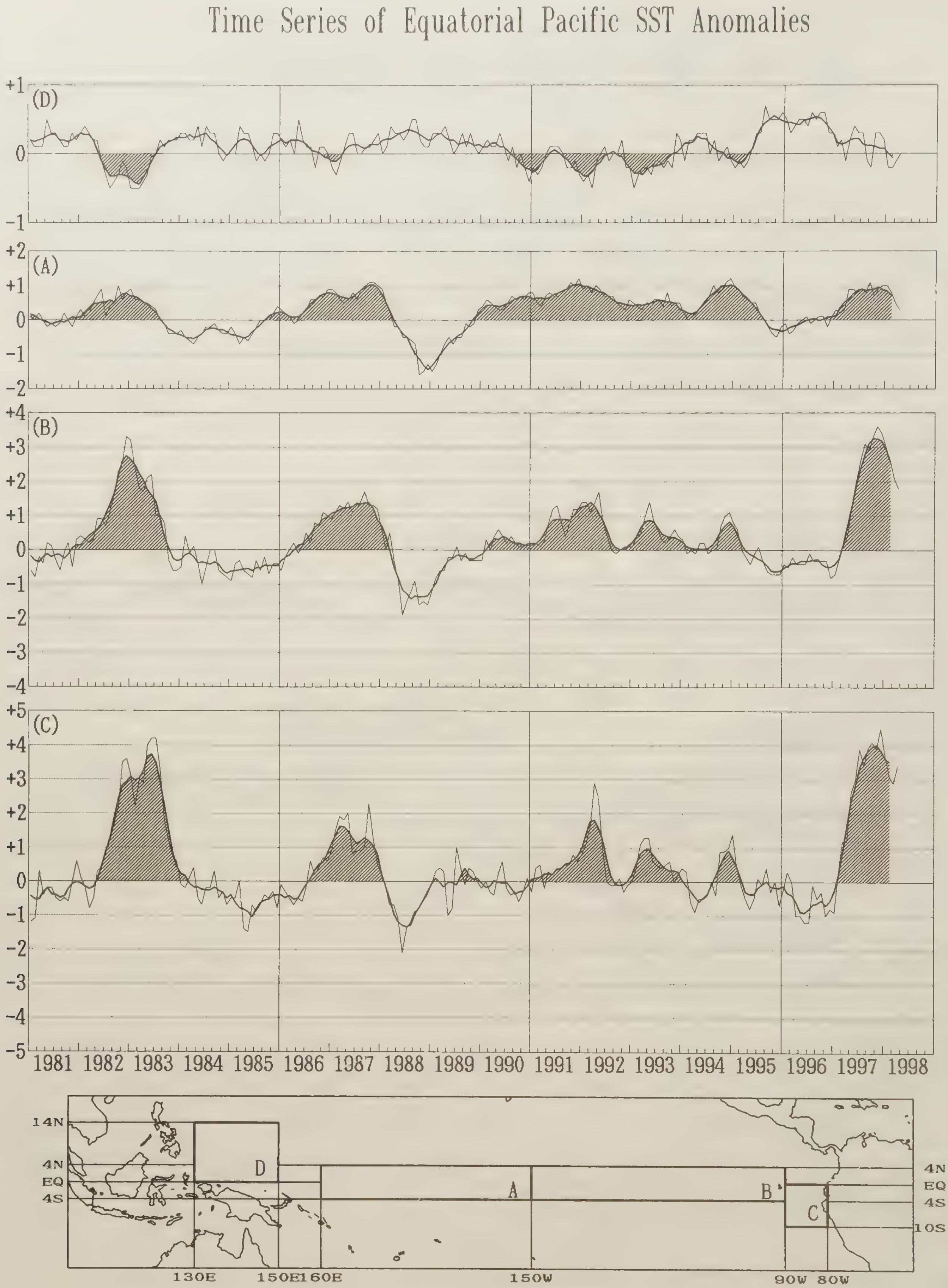
Long-term Variation of Monthly Mean SST Anomalies



第23図 海域平均海面水温偏差の長期変動

Fig.23 Long-term variations of monthly mean sea surface temperature anomalies (°C) for the areas shown in the right panel. Anomalies are computed from the JMA climatology (1961-90). Thin lines show the monthly mean and thick lines their 13-month running means.





第24図　太平洋赤道域の海面水温偏差時系列図

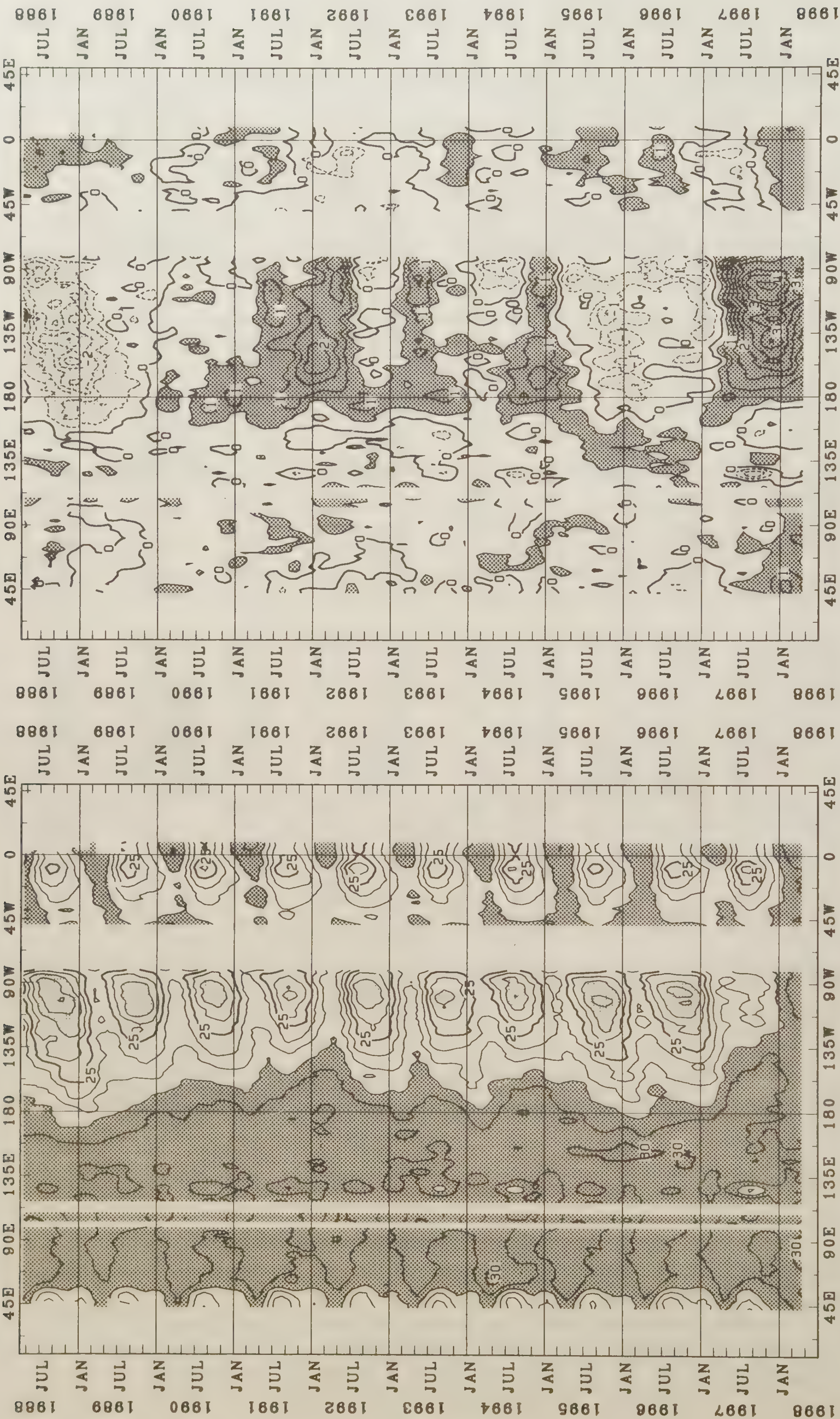
Fig.24 Time series of monthly mean SST anomalies (°C) in the equatorial Pacific Ocean for the areas indicated at the bottom panel. Thin lines show the monthly means and thick lines their 5-month running means. Positive anomalies (A, B, C) and negative anomalies (D) are shaded. Anomalies are computed from the JMA climatology (1961-1990).

El Nino Monitoring Indices

	SEA SURFACE TEMPERATURE AND ANOMALY (°C)								SOI	SEA LEVEL PRESSURE ANOMALY (hPa)	
MONTH	REGION D 14N-EQ 130E-150E		REGION A 4N-4S 160E-150W		REGION B 4N-4S 150W-90W		REGION C EQ-10S 90W-80W		SOI	TAHITI 17-33S 149-37W	DARWIN 12-24S 130-52E
JAN 96	29.0	0.5	27.9	-0.1	25.0	-0.4	24.1	-0.2	0.8	1.0	-0.7
FEB 96	28.6	0.3	27.6	-0.4	25.7	-0.5	26.0	0.3	0.1	-0.2	-0.5
MAR 96	28.8	0.4	27.8	-0.3	26.7	-0.2	25.9	0.0	0.7	1.0	-0.3
APR 96	29.3	0.5	28.1	-0.1	26.7	-0.4	24.1	-1.0	0.8	0.5	-0.5
MAY 96	29.6	0.5	28.5	0.0	26.2	-0.4	22.9	-1.0	0.3	1.2	1.2
JUN 96	29.7	0.4	28.6	0.1	25.7	-0.4	21.5	-1.2	1.4	1.6	-0.2
JUL 96	29.8	0.6	28.4	-0.1	25.1	-0.1	20.4	-1.2	0.7	0.6	-0.6
AUG 96	29.6	0.5	28.4	0.0	24.3	-0.3	20.5	-0.1	0.4	0.4	-0.3
SEP 96	29.8	0.6	28.4	0.1	24.3	-0.3	19.8	-0.5	0.5	-0.7	-1.7
OCT 96	29.9	0.6	28.5	0.1	24.3	-0.3	20.4	-0.3	0.4	-0.1	-0.8
NOV 96	29.5	0.3	28.2	-0.2	24.3	-0.3	20.5	-1.0	-0.0	-0.5	-0.5
DEC 96	29.2	0.3	28.3	0.1	24.1	-0.8	21.8	-0.8	0.8	-0.3	-1.9
JAN 97	28.6	0.1	28.3	0.3	24.7	-0.7	23.4	-0.9	0.3	1.7	0.9
FEB 97	28.5	0.2	28.2	0.2	25.9	-0.3	25.9	0.2	1.2	1.0	-1.9
MAR 97	28.3	-0.1	28.4	0.3	27.0	0.1	27.1	1.2	-0.6	-0.5	0.9
APR 97	29.0	0.2	29.1	0.9	27.5	0.4	26.3	1.2	-1.1	0.4	2.3
MAY 97	29.5	0.4	29.4	0.9	27.9	1.3	26.5	2.6	-2.5	-2.1	0.9
JUN 97	29.6	0.3	29.3	0.8	28.1	2.0	25.7	3.0	-2.3	-0.8	2.1
JUL 97	29.5	0.3	29.4	0.9	27.8	2.6	25.5	3.9	-0.8	-0.1	1.2
AUG 97	29.0	-0.1	29.2	0.8	27.7	3.1	24.0	3.4	-2.0	-0.9	2.2
SEP 97	29.0	-0.2	29.4	1.1	27.5	2.9	24.2	3.9	-1.4	0.1	2.7
OCT 97	29.6	0.3	29.1	0.7	27.9	3.3	24.8	4.1	-1.6	-0.2	2.7
NOV 97	29.5	0.3	29.3	0.9	28.2	3.6	25.4	3.9	-1.2	0.4	2.7
DEC 97	29.1	0.2	29.2	1.0	28.3	3.4	27.1	4.5	-0.9	-0.5	1.1
JAN 98	28.3	-0.2	29.0	1.0	28.4	3.0	28.0	3.7	-2.3	-3.6	1.4
FEB 98	28.1	-0.2	28.8	0.8	28.8	2.6	28.8	3.1	-1.8	-0.9	3.5
MAR 98	28.3	-0.1	28.6	0.5	29.0	2.1	28.8	2.9	-2.5	-2.8	2.3
APR 98	28.8	0.0	28.5	0.3	28.9	1.8	28.5	3.4	-2.3	-1.5	1.5

第1表　エルニーニョ監視指数

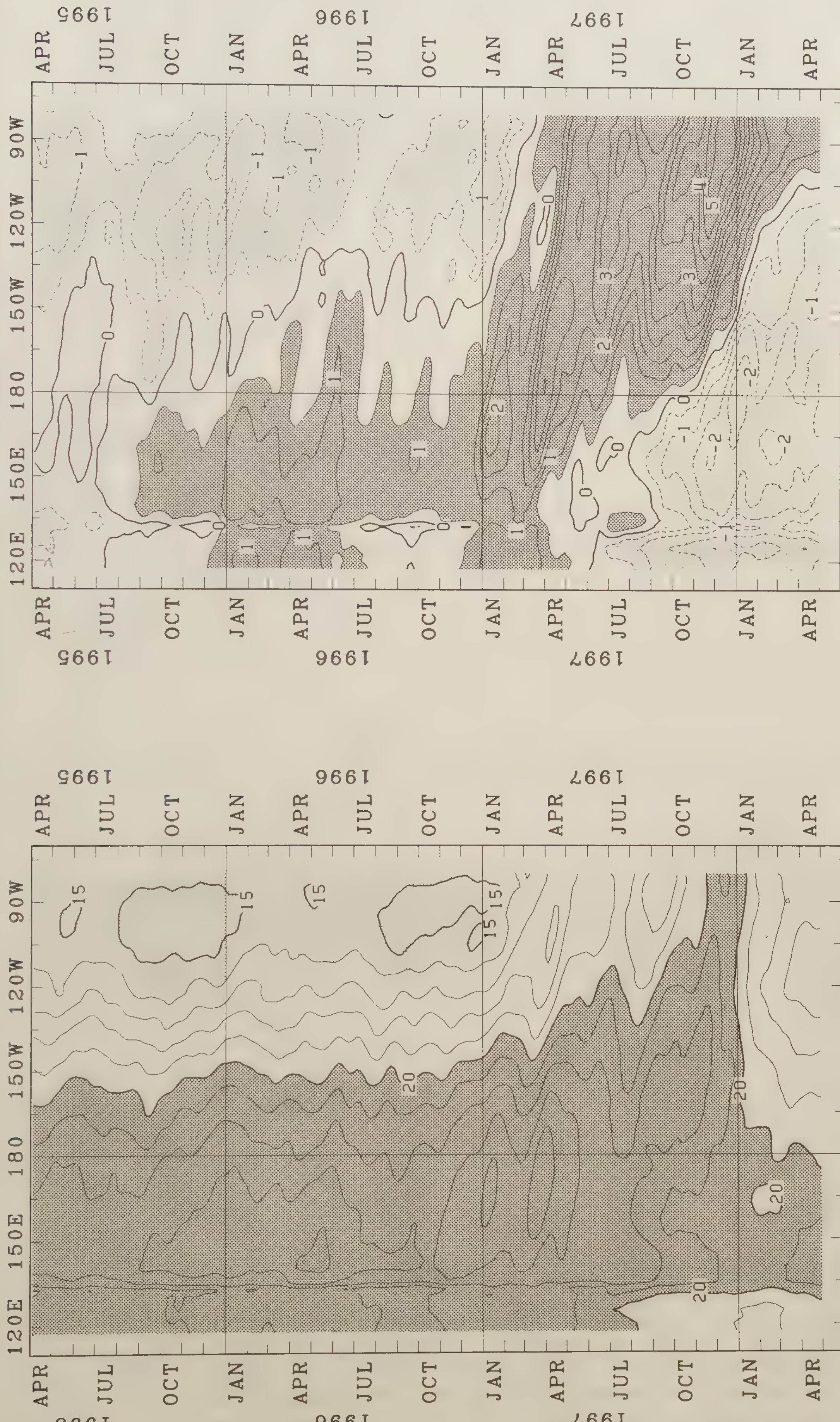
Table 1 El Nino Monitoring indices



第 25 図　赤道に沿った海面水温（左）および偏差（右）の時間-経度断面図

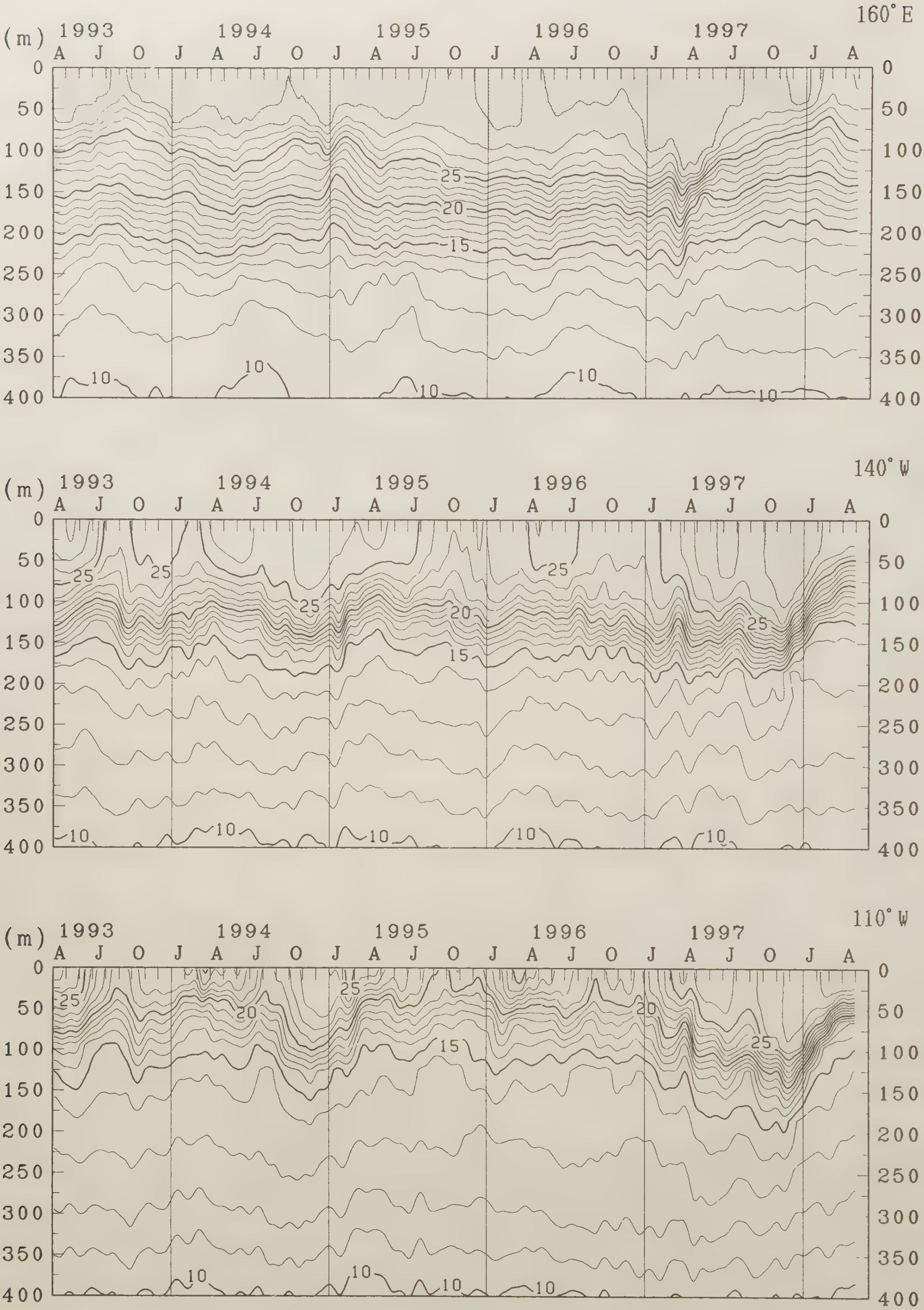
Fig.25　Time-longitude sections of SSTs (left) and anomalies (right) along the equator (2°N-2°S) in the global ocean. Contour interval is 1°C (left) and 0.5°C (right). Values greater than 28°C are shaded and values less than 23°C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1961-1990 base period means.

Time-Longitude Sections of Ocean Heat Content & Anomalies (Eq.)



第26図　太平洋の赤道に沿う海洋表層の貯熱量（左）及び偏差（右）の時間－経度断面図

Fig.26 Time-longitude sections of ocean heat content in the upper 260m along the equator (left) and anomalies (right) in the Pacific Ocean. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (left) and 0.5°C (right). Values greater than 20°C are shaded and values less than 16°C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1987-1996 base period means.



第27図　太平洋赤道域の表層水温の時間－深度断面図

（上：西部、中：中部、下：東部）

Fig.27 Time-depth sections of equatorial subsurface temperature for the western Pacific (top, 160°E), the central Pacific (middle, 140°W) and the eastern Pacific (bottom, 110°W). Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C. Values greater than 28°C are shaded.

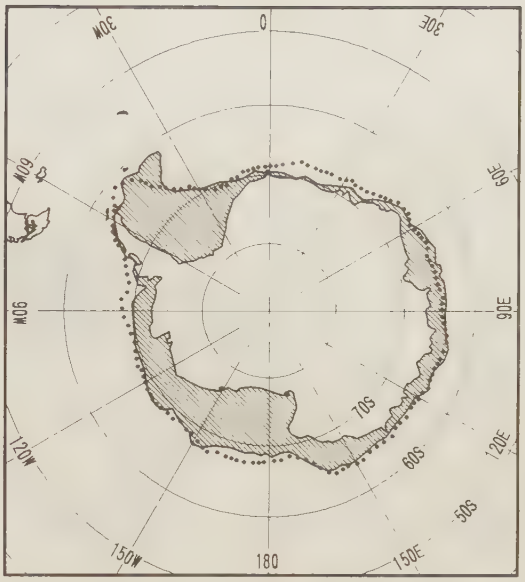


第28-1図 北極域の海氷図（1998年 4月17日）

Fig.28-1 Sea ice chart in the Arctic on 17 Apr. 1998.

The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1972 through 1990.

The data source is the National Ice Center (USA).

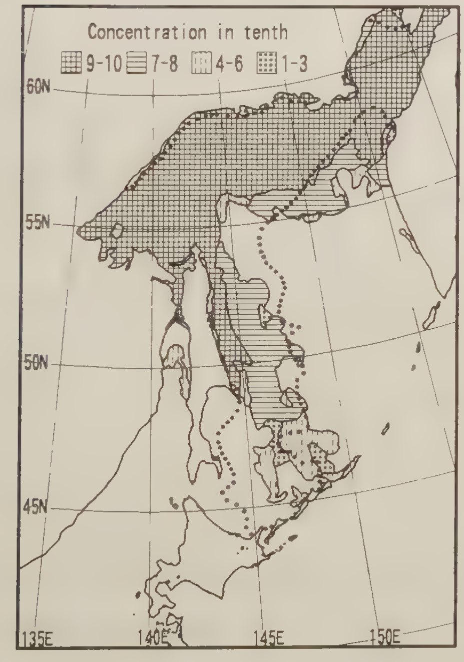


第28-2図 南極域の海氷図（1998年 4月14日）

Fig.28-2 Sea ice chart in the Antarctic on 14 Apr. 1998.

The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1973 through 1990.

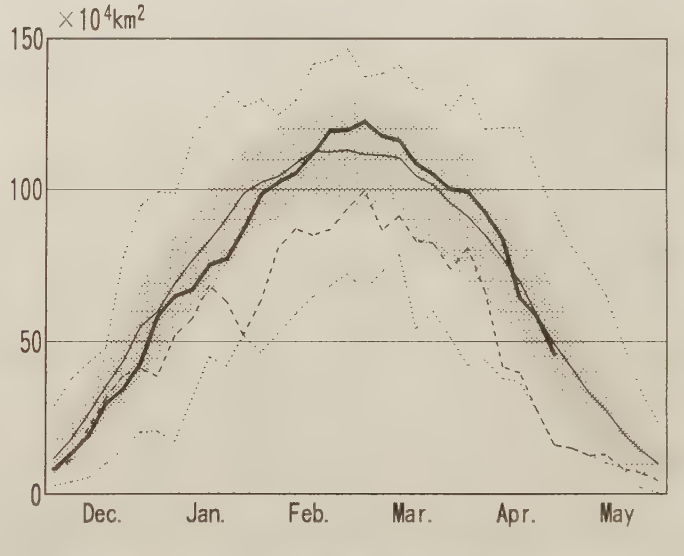
The data source is the National Ice Center (USA).



第28-3図 オホーツク海の海氷図（1998年 4月15日）

Fig.28-3 Sea ice chart in the Sea of Okhotsk on 15 Apr. 1998.

The dotted line denotes the mean ice edge averaged for the period from 1971 through 1990.



第28-4図 オホーツク海の海氷域面積（1997-1998）

Fig.28-4 Time-series of 5-day sea ice extent in the Sea of Okhotsk (1997-1998).

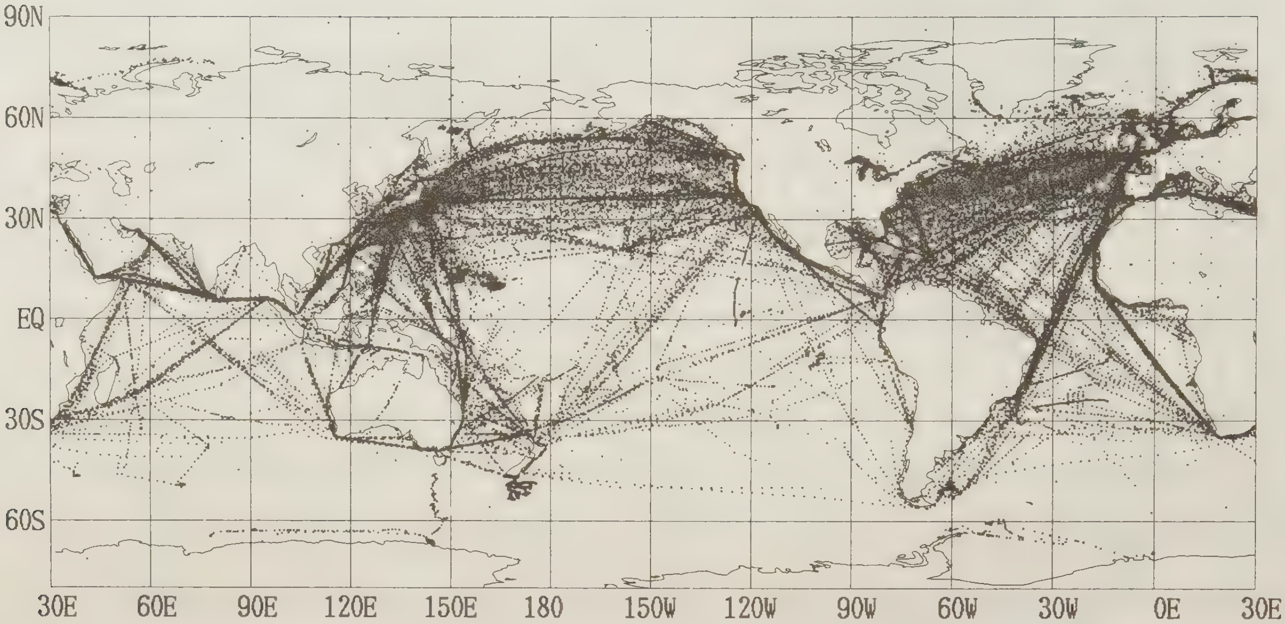
: current season (1997/98)

: mean extent (1971-1990)

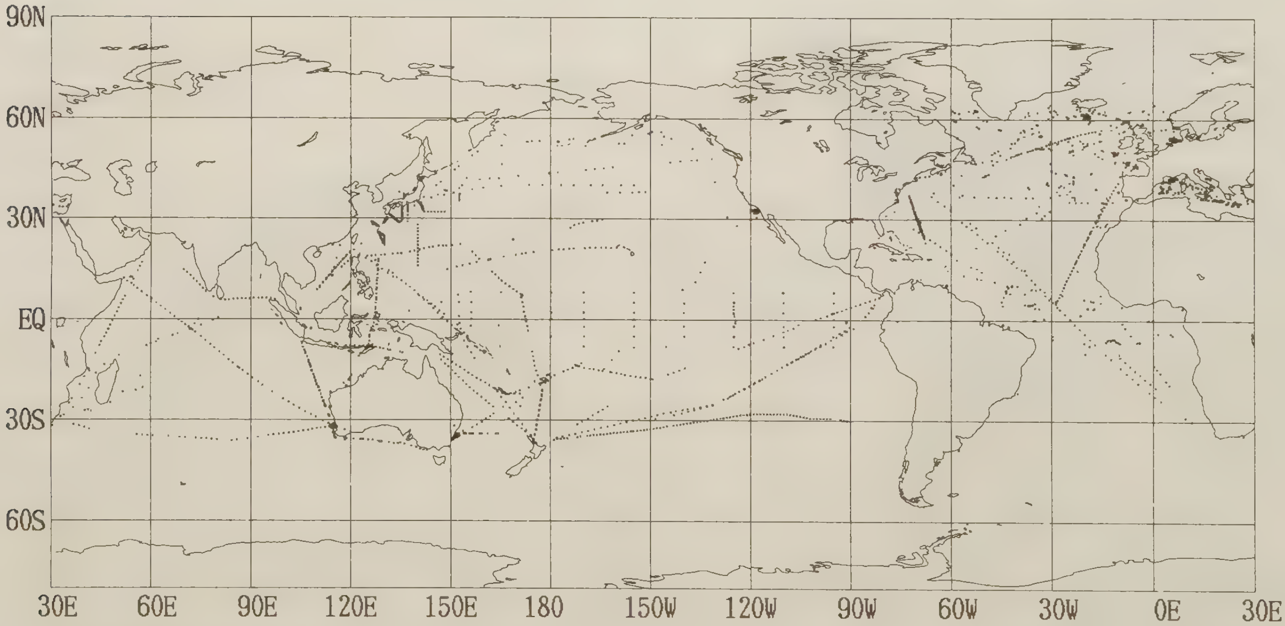
: maximum or minimum extent (1971-1997)

: last season (1996/97)

: mean $\pm 1\sigma$ (1971-1990)



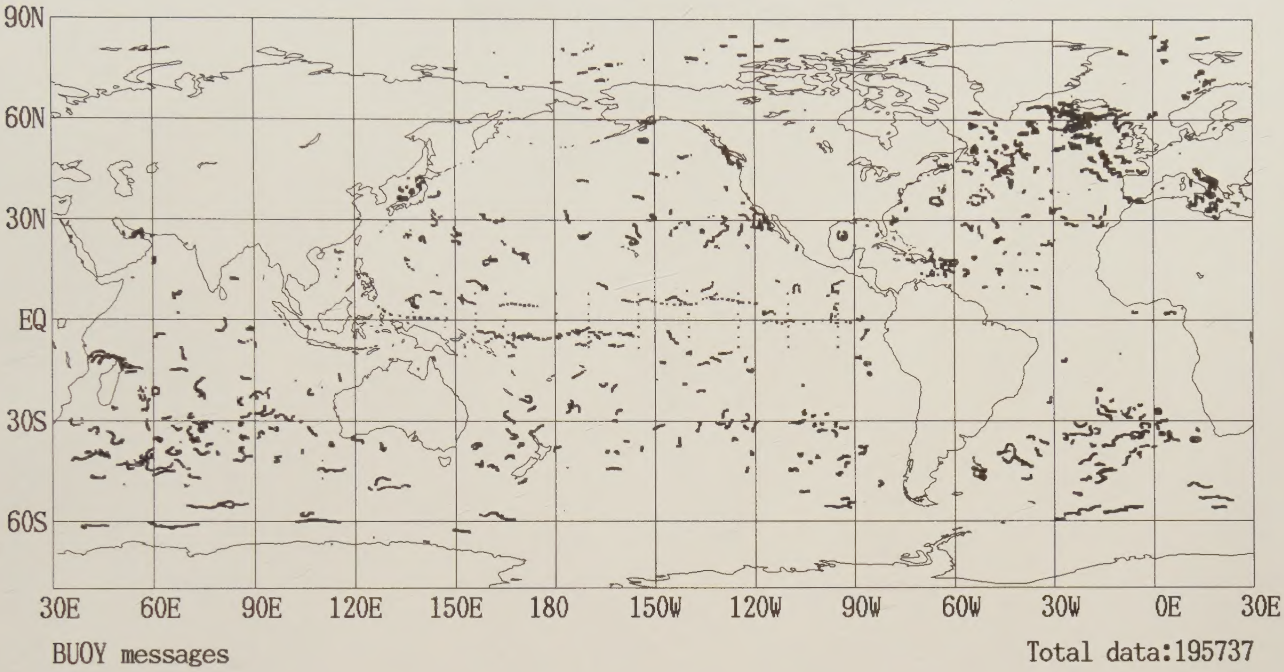
SHIP messages Total data:103596

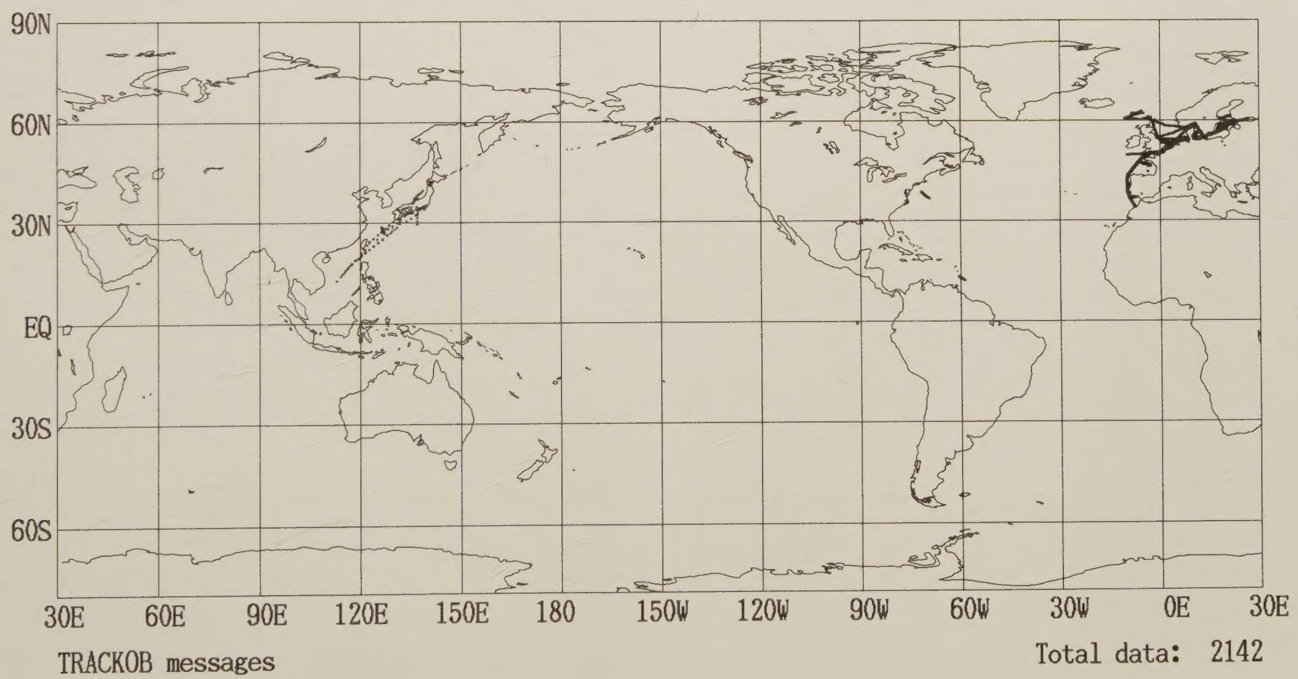


BATHY/TESAC messages Total data: 4195

第29-1図　測点分布図(1998年 4月)

Fig.29-1 Geographical distribution of SHIP messages (SST data, top) and BATHY/TESAC messages (subsurface temperature data, bottom) for APR 1998.





第29-2図　測点分布図(1998年 4月)

Fig.29-2 Geographical distribution of BUOY messages (buoy drift and SST data, top) and TRACKOB messages (ship drift and SST data, bottom) for APR 1998.

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